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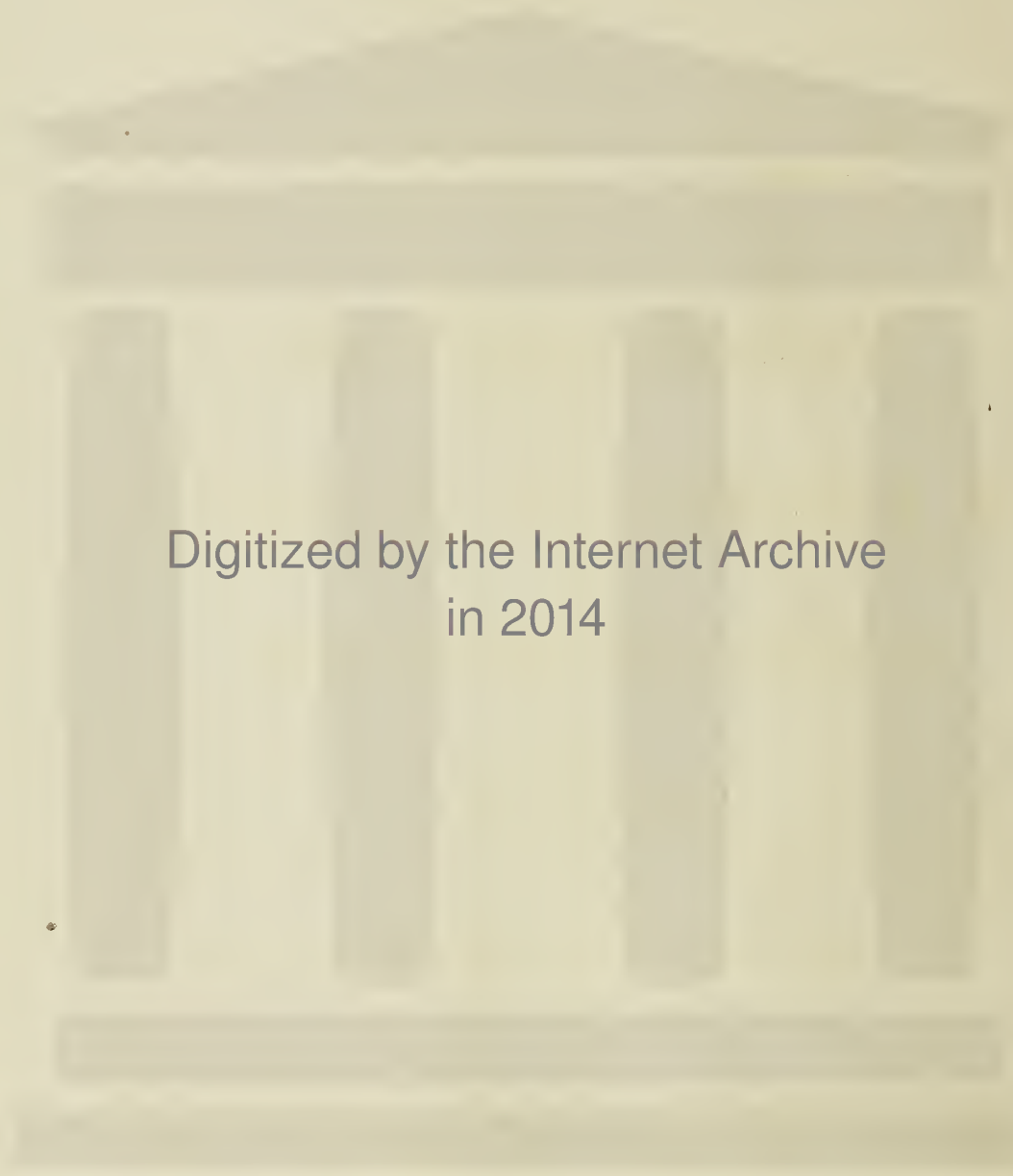
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CITY AND COUNTY OF SAN FRANCISCO
DEPARTMENT OF PUBLIC WORKS
BUREAU OF ENGINEERING
M. M. O'SHAUGHNESSY, CITY ENGINEER

RECOMMENDATION
OF
M. M. O'SHAUGHNESSY, City Engineer
ON
REFUSE INCINERATOR.

AUGUST, 1929.

PURSUANT TO RESOLUTION NO. 31,004, NEW SERIES, OF THE BOARD OF SUPERVISORS, ADOPTED JUNE 10, 1929, AND APPROVED JUNE 13, 1929.

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August 12, 1929.

Honorable James Rolph, Jr., MAYOR,
and
Board of Supervisors,
City and County of San Francisco.

Gentlemen:

I am transmitting you herewith copy of my report on the garbage situation in San Francisco, especially with its relationship to disposal in other cities.

For this purpose I was authorized by you to take a trip to eastern cities commencing June 28, 1929, when I left San Francisco for Chicago, arriving there July 1st and spending three days there; then going to New York, where I was from July 4th to July 9th; then going to Toronto, Canada, where I spent a day examining both their incinerators; thence to St. Paul and Minneapolis, where I spent another day, came over the Milwaukee Railway to Seattle, where I spent a day; then to Portland, Oregon, and back to San Francisco on July 15, 1929.

The most noticeable accomplishment in garbage collection and disposal is at Toronto, Canada, where both ashes and garbage are collected at public expense at an annual cost of $1,112,500., 121,062 buildings being collected from at an annual cost of $9.19 per building. A cardinal rule of their Department is, "Do not mix ashes with garbage. Use separate metal receptacles. Tie all loose papers separately in bundles. Leave receptacles at side entrance near front corner of building, where possible. Do not place at curb."

Incineration has been adopted for the disposal of garbage and combustible material. The Don Destructor burns 180 tons per day at a cost of $1.46 per ton. The more modern Wellington Destructor built in 1925 burns garbage at $1.09 per ton. This is more economical than any other plant we examined except that of Portland, Oregon, where the garbage

on the west sideof the Willamette River is burned at a cost of 78 cents per ton for labor only. Portland's yearly bill for burning garbage is $47,000.

The collection of garbage in Portland is like that of San Francisco - by private collectors, who charge the householders a fee each month, which is slightly less than San Francisco rates.

Portland has $240,000. appropriated for the construction of a new incinerator on the east side of the Willamette River, but cannot get the property owners to agree on a site. This objection I believe to be sentimental as the modern incinerators at New York and Toronto are entirely free from objectionable odors and are located near large hospitals and school buildings without complaint.

Los Angeles collects its 182,180 tons of garbage by municipal collection at a total annual cost of $682,538. less $94,243. revenue from sale after collection, or $3.22 per ton. A large portion of its food garbage is fed to the Fontana 40,000-hog farm. The average quantity of garbage fed is 19 pounds per head per day and the gain in weight of the hogs is from 40 pounds to 80 pounds per ton.

Los Angeles has a small Nye incinerator, which burns about 150 tons a day of combustibles, v Three receptacles used by property owners,- one for garbage, one for ashes, and one for paper and wood. The collection is made twice a week. Los Angeles has also had its tribulations with experiments in disposing of garbage with the abandoned Cobwell process plant, which cost over $1,000,000.

Seattle spends yearly $701.622, for collection and dumping of garbage on the marshes. Those dumps occasionally take fire and are a nuisance.

The accompanying report gives technical details of the plants visited, as well as copies of reports by engineers of other cities of this country which have investigated the subject. Enough information was developed to convince us of the wisdom of building a first class modern plant that will serve the present needs of the City, and tentative suggestions for specifications are enclosed herewith.

Very respectfully,

M.M.O'Shaughnessy
City Engineer

MMO'S/AO

CITY AND COUNTY OF SAN FRANCISCO

DEPARTMENT OF PUBLIC WORKS

BUREAU OF ENGINEERING

X-1063
7/30/29

ADDRESS ALL COMMUNICATIONS TO THE CITY ENGINEER

IN YOUR REPLY, REFER TO FILE

August 5, 1929.

Honorable James Rolph, Jr., MAYOR,
and
Board of Supervisors,
City and County of San Francisco.

Gentlemen:

I transmit herewith my report, pursuant to your Resolution No. 31004 (New Series), approved June 13, 1929, requesting recommendation on garbage incinerators, and which reads as follows:

"Whereas, the Committee on Public Health, after an extensive study, has reported to this Board its recommendations as to the disposal of garbage within the City and County of San Francisco; now, therefore, be it

"Resolved by the Board of Supervisors, that we hereby declare and adopt as a matter of policy for the treatment of garbage disposal, the following:

"1. That incineration be adopted as the means of disposing of San Francisco garbage.

"2. That the necessary steps be taken to secure a site for the new incinerator adjacent to the present site of old incinerator.

"3. That the incinerator shall be municipally-owned, built, and operated.

"4. That the City Engineer be requested to make a tour of eastern cities for the purpose of determining the best type of garbage incinerator for San Francisco and to report his recommendations to the Board of Supervisors. "

I am aware that there may be many of the members of your Board not thoroughly conversant with some of the facts in the history leading up to the resolution above referred to, and am therefore incorporating certain data preceding my report, covering the garbage conditions in San Francisco from 1896 to

August 7, 1939.

Honorable James Rolph, Jr., Mayor,
and
Board of Supervisors,
City and County of San Francisco.

Gentlemen:

I transmit herewith my report, pursuant to Joint

Resolution No. 31209 (New Series), approved June 13, 1939,

requesting recommendation on pending condemnation, and action

taken in relation

"Pursuant, the Committee on Public Health, City
in Executive Study, was requested to file Board its
recommendations as to the disposal of property within
the City and County of San Francisco, now, therefore,
be it

"Resolved by the Board of Supervisors, that an
annual increase and apply as a result of policy for
the investment of capital directly, and following

"2. That buildings be acquired as the needs
of disposing of San Francisco additions.

"3. That the necessary steps be taken to ac-
quire a site for the San Francisco relocated to the
present site of the Embarcadero.

"4. That the contracts should be considered
among, multi, and expenses.

"5. That the City Engineer be requested to
make a plan of action within the purpose of ac-
tivating the next type of capital investment its
San Francisco and to report his recommendations to
the Board of Supervisors. *

I am aware that there may be need of the Committee
for Board and Municipal purposes with some of the lands of
the Mayors Committee as its recommendations above referred to
as investing investigating facilities site disposition of property
within the proposed facilities to be located. Time does to

the latter part of 1928 (Exhibit "A"); also, attaching for reference, certain resolutions and reports on the subject previously rendered by the Health Committee of the Board of Supervisors, with special reference to a "Progressive Report on Garbage Disposal in Various Cities," submitted to your Board on November 1, 1928 (Exhibit "B"); also a further report of the Committee on Public Health in regard to Garbage Disposal, submitted to the Board of Supervisors on April 29, 1929 (Exhibit "C").

A letter from the City Attorney read before the Board of Supervisors on June 10, 1929, stated that in the application before Judge Mogan for an injunction against the incinerator, the Judge indicated that he would grant the injunction and make it permanent after approximately 60 days, or such time as it would take the Supervisors to determine the method of disposal, either by fill and cover, or by the construction of a new incinerator in the vicinity of the present one.

Resolution No. 31004 (New Series) requests that I make a visit to eastern cities for the purpose of determining the best type of garbage incinerator for San Francisco.

I first inspected the 600-ton Superior plant in Chicago on July 1, 1929. A cursory examination would give one the impression that the plant presented a fairly good appearance, with special reference to sanitary conditions, especially when the materials were not coming into the plant very

31 General View, Superior Plant 7-3-29

28. Superior Plant Showing incombustible Residue, Chicago 7-3-29

20. Superior Plant, Chicago and Furnace Residue 7-1-29

heavily and the employees had ample opportunity to clean up on all operations.

However, on a further detailed study and observation, under full load conditions, at two different times, particularly July 10, 1929, various deficiencies appeared that evidently pointed to lack of experience by the builders in the design of a large plant of this size and the overlooking of various details on plans necessary to its success, which is often the case on the completion of a first large and necessarily experimental plant.

The principal points and features that appeared outstanding upon later visits, July 2nd and July 10th, 1929, are as follows:

1. Apparent lack of garbage storage space and consequent slow handling of incoming teams; tractors and trailers were lined up in four or five different directions, 5 ot 6 trailerloads to the string waiting a chance to unload. It would appear that more dumping room is required with possible additional storage space adjacent to the charging openings.

2. Lack of head room between the grates and the ash pit below, resulting in a lack of ash storage, with high temperature conditions for operators, making it a difficult place to work.

3. Insufficient room between building and furnace stoking doors to allow proper handling of the fires.

4. The handling of materials by crane and clamshell bucket from storage pit to furnace not satisfactory.

The buckets do not get a clean good hold of the materials, especially when boxes, trees, or other bulky matter are encountered, with the result that garbage debris is scattered all over the floor and traveling path of the crane and bucket, with a consequent army of flies.

It is also quite evident that the pit will not be entirely cleared of debris by the buckets and where the plant is subject to fairly continuous operation, it is fair to assume that the lower portions of the pit will not be cleared of materials from time to time, and as a result become quite insanitary and offensive. The bucket also strikes quite frequently against the wall separating the pit from the furnace room. These walls are of reinforced concrete, faced with yellow brick, and are being continuously damaged.

Even with a correction of all those structural defects, there is still nothing to substantiate the claim that the combustion performance of this plant is superior to other plants,-

(a) There being considerable smoke observed from the stack.

(b) Temperature ranges on charts displayed were not constant.

(c) The cost of incineration per ton could not be definitely ascertained as being economical. A month's observation by the New York Engineer shows a cost exceeding $2.50 per ton.

(d) Additional fuel consisting of coal, was used to promote proper combustion.

On July 10th there were twenty trucks with 60 garbage trailers waiting for an opportunity to dump their contents. Each truck had two drivers at $7.00 per day each, and in most cases the assistant driver had an arm chair for reclining in periods of repose.

All indications pointed to experimental attempts by the builders to attain perfection rather than practical operating experience based on previous large plant work, and there is apparently no outstanding detail either in the plant arrangement, building arrangement, method of handling materials, combustion methods, or sanitary appearance of the plant, to call for any definite recommendation to be followed in a plant for San Francisco.

For your information I am attaching hereto copy of a report made by Mr. L. D. Gayton, City Engineer of Chicago, in June 1925, and addressed to Honorable A. A. Sprague, Commissioner of Public Works, Chicago, (Exhibit "D"), wherein, after an exhaustive investigation personally made throughout the country, prior to the installation of a Superior Plant, he recommended the following types of incinerator be considered for the City of Chicago, namely, Balmer, Sterling, and Heenan.

I am also attaching hereto a report covering observations of a period of about a month of the Chicago incinerator, made by J. C. Landon, Assistant Engineer, under the direction of E. C. Goodwin, Examining Engineer, of the City of New York, (Exhibit "E"), calling attention to various deficiencies in this plant, and also giving fairly detailed data as to cost of

operation. It will be noted that the cost per ton arrived at under contract, including fuel and fixed charges, was $3.39 per ton, and under City operation $2.56 to $2.86 per ton.

In Chicago the Superior plant, like all incinerators in other American cities, burns rubbish and garbage only; ashes are separately collected and hauled to a separate dump.

An inspection of the 550-ton Decarie type plant at 56th Street and 12th Avenue, New York, which in addition to the burning of the garbage and rubbish, generates steam to the extent of 1300 k.w., indicates that it requires help of a highly trained character both in stoking and operating auxiliaries, and employs licensed engineers. This plant is favorably situated in a district apparently contributing a large percentage of rubbish. Although figures are available as to the exact proportions of rubbish and garbage and costs of operation, (Exhibit "G"), my own observation would warrant reporting against the adoption of this type of plant. There would be no real objective in obtaining steam except to operate auxiliaries such as blowers, lighting, etc., and it is my recommendation that any power needed for these auxiliaries be obtained from regular sources. This would probably be cheaper and more satisfactory than the installation of a boiler type incinerator, with its mass of water tubes calling for constant attention, and its attendant high cost of operation, the commonest labor

around the New York furnaces receiving $6.00 per day. In the past four years, under Mayors Hylan and Walker, no further incinerators of the Decarie type have been installed in New York.

Observations of one of the latest 400-ton Sterling plants erected by the Bartlett & Snow Co. of Cleveland, Ohio, at 73rd and Exterior Streets, New York, created a very favorable impression, with special reference to the following:

(a) Exterior plant appearance.

(b) Method of handling trucks within the interior of the building.

(c) Method of storing, together with possibilities of increasing storage space.

(d) Consistent cleanliness of plant, with special reference to charging floor and stoking floor.

(e) Apparent lack of smoke and ash emission from stack.

(f) Handling of ash from the grates to the trucks.

(g) Appearance of fire.

Cost data and statistics on plant (Exhibit "G") are as shown in detail.

Copy of tests showing burning capacity of plant indicates that although the plant is guaranteed for a capacity of 320 tons per day of 24 hours, the average tonnage burned on the 24-hour basis is 519 tons. Temperature in combustion chamber ranged fairly constant between 1400 and 1800 degrees Fahrenheit.

400 TON STERLING PLANT - 73rd AND EXTERIOR STS. N.Y.

59. The Don Destructor, Toronto 7-9-'29.

9. Sterling Plant of 73rd & Exterior Sts New York 7-5-2

8. Sterling Plant ~ 73rd & Exterior St, New York 7-5-'29

The cleanliness of this plant, its freedom from smoke, smell, or other nuisances, makes it of outstanding character.

A small Nye plant at White Plains of 150 tons capacity in 24 hours, with manual feed, is very well laid out, with special reference to exterior appearance. At the time this plant was visited, Saturday, July 6, 1929, there was an evident attempt on the part of the operators to burn all the refuse by noon, so that employees could have the balance of the day off. As a result, the charges to the furnace were heavy, smoke was in evidence at the stack, together with a small amount of ash, and this would be further aggravated whenever forced draft was heavily used. My impression is that more storage space, together with a more constant feeding arrangement would do away with the smoke and ash nuisance.

On the afternoon of July 6th I examined the new four-unit Nye plant, just erected at Clifton, Staten Island, completed at a cost of $179,000., including building, in four months time, to burn 150 tons daily of Staten Island garbage. This is one of the boroughs of Greater New York, and so generous is the measure of Home Rule that any small department exercises its right of selection as to type of plant.

The furnaces are fed by four circular holes, each 28 inches in diameter, from an elevated floor level on which the garbage is dumped from collecting wagons, and one man attends to the feeding of each furnace.

150 TON NYE PLANT. WHITE PLAINS, N.Y.

150 TON NYE PLANT - WHITE PLAINS, N. Y.

150 TON NYE PLANT - WHITE PLAINS N Y

This plant was erected to replace an Heenan-Froude plant of the same type and age as the condemned Army Street plant in San Francisco, and promises to make a satisfactory solution of the disposal of Clifton garbage for the years to come.

On returning from this plant I drove over the new Goethals bridge from Staten Island to Elizabethtown, where offensive garbage dumps were burning, polluting the atmosphere on the Marsh Boulevard to Newark and Jersey City.

A 500-ton Heenan plant (which is practically the old Heenan-Froude type, modified and brought up to date as a result of past experiments) has been erected and just completed for Brooklyn Ash Removal Company, South Brooklyn, by the Hiler Engineering Company of Brooklyn, and presents some additional features on the subject of garbage and rubbish disposal not heretofore used to any great extent, one of the features being the addition of rubbish-sorting equipment consisting of mechanically operated belts on which rubbish is dumped and sorted therefrom. The residue goes directly into the charging bins of the furnaces. There is also an hydraulic sluicing method of ash removal whereby the ashes are sluiced directly into an ash bin and from the ash bin hoisted by means of a crane operated bucket and loaded directly into barges, anchored adjacent to the plant.

There is considerable mechanical equipment in this plant. The first load of material was hauled into the plant on the date of my visit, namely, July 8, 1929. It presents a

very attractive and complete unit and the workmanship throughout the plant looks good. The results of operation, however, have still to be ascertained, but the contract of the Brooklyn Ash Removal Company with the City of Brooklyn calls for disposa of all materials at 58 cents per cubic yard. This includes ash, garbage, and rubbish. Complete specifications and plans covering this plant, together with the contract between the Company and the City of New York, have been supplied by Mr. C. R. Van Etten, President of the Brooklyn Ash Removal Company. Stringent guarantees were required in the specifications, a noticeable item being that there would be no more than 1.1 man hours per ton of labor required for the operation of the plant, exclusive of the rubbish salvaging labor. Definite data could not be obtained as to proportions of materials that could be expected to come into the plant, so that the reduction from 58 cents per cubic yard to a tonnage basis could not be made.

At Toronto I examined one 300-ton Don Sterling Destructor built in 1917 and one 400-ton Wellington Sterling Destructor built in April 1925. Both of these plants were well handled and apparently gave good results. They appeared to be substantial in character, and the method of handling the materials from truck to bin is very good. These are the only plants from which I have been able to obtain official City records appertaining to the costs of operation.

For a period of over 12 years this plant has been operating in close proximity to an hospital, a high school,

and in a high class residential district, and in all that period not one word of complaint or objection has been made by the neighboring residents to the city officials of Toronto.

The Wellington plant, 400 tons daily, located at Wellington near Niagara Street, is the latest, and shows by official report to be burning garbage at a cost of $1.12 per ton, which includes fixed charges. Furnaces appear to give good combustion and there is practically no smoke nor ash from the chimneys. The interior of the plant is fairly clean, especially the stoking floors.

I am taking the liberty of attaching hereto a very enlightening article entitled "A New Refuse Destructor at Toronto, Ontario," by J. A. Burnett, Superintendent of Incineration, (Exhibit "H").

Inspection of the 200-ton Goder Plant at Minneapolis did not bring to light any features that seemed to have any value over and above what was observed at other plants. In fact, one of the Goder furnaces was replaced after two years service by a new type of furnace developed under City Engineer Mr. Ellsberg in charge of the plant. This new furnace has been in operation less than a month, so that statistics covering the economics of operation are not available. The building in which the plant is installed is too cramped, the furnaces need a constant coal feed to start and stimulate the fires, and smoke in the upper floors makes the occupancy of the building unbearable.

The 150-ton 24-hour Nye plant at Portland is apparently giving a good account of itself. At the present time it is burning about 96 tons per day, 2 shifts, total 14 hours, at a cost of approximately 78 cents per ton for labor only.

at a cost of approximately 78 cents per ton for labor only.

CONCLUSIONS

My inspection of the various plants visited, taking into account such figures as were available at the time of my visit and fully realizing that official figures were lacking in some instances, leads me to state that the type of plants now in use in Toronto and Portland appear to give the best results in reference to cost of operation, also the appearance of the interior and exterior of the plants and absence of nuisance, and are commendable.

I find from my observations of all plants visited that as a result of experience gained on the part of the manufacturers during the last 20 years in the construction of incinerators, they are rapidly overcoming various defects and have now acquired fairly complete knowledge of furnace and plant construction. It would be advisable, and I recommend obtaining the benefits of competitive open bidding of selected types, rather than to specify any particular make or type of plant.

In calling for bids I recommend setting up certain requirements, which would tend to limit the bidding to such firms as have sufficient means and have plainly established their ability to construct guaranteed plants under bond, complying with such requirements. Among such requirements would be the following:-

1. Bidders should have an established reputation as builders of incinerating plants for the past ten years and should have at least one plant of 300 tons capacity for 24 hours in actual operation for two years on a practical basis.

2. Guarantees covering man hours per ton of refuse burned to be detailed into the respective operations.

3. Guarantees covering power consumption.

4. Guarantees covering temperature limits in reference to combustion chamber, furnaces, and stack.

5. Statements as to the use of additional fuel.

6. Guarantees covering rate of burning in pounds of refuse per square foot of grate area per hour.

7. No nuisance shall be created by the escape of gases, odors, or dust from chimney or building.

8. Contractor should be bonded for at least 100 per cent of the cost of the plant over a two-year period, to cover guarantees.

9. As the building is really an integral part of the plant, it is recommended that the bidders compete on a complete plant consisting of equipment, building, and foundations, such construction to conform to the building laws and to the type or class of building specified.

10. The City should not be restricted to the low bid and should be allowed to take into account all factors tending towards the best interests of the City.

It would further appear from the observations that refuse cannot be disposed of for One Dollar per ton, as is now being accomplished imperfectly in the old San Francisco plant, if all fixed charges, maintenance, operation, and disposal of ash are taken into consideration. I mention this in view of the fact that an ordinance now in effect distinctly states that the maximum charge shall not be more than One Dollar per ton for disposal of garbage.

Respectfully submitted,

M.M.O'Shaughnessy
City Engineer

MMO'S/AO

Encl.

G-12.1, 21

Chicago Tribune
July 10, 1929

ETTELSON FACES ALDERMEN AND WINS IMMUNITY

Eaton's Charges Cause Bitter Debate.

Ald. Charles S. Eaton [5th] and Ald. Arthur F. Albert [43d], who have been demanding that the state's attorney investigate the corporation counsel's office, received another rebuff yesterday when the council finance committee pigeonholed Eaton's resolution asking such an inquiry.

The two hour session before the committee was taken up mainly with the twenty-three page answer of Corporation Counsel Ettelson to the accusations of the two aldermen and with the efforts of committee members to absolve themselves. The session was marked with acrimonious charges and slurring remarks.

After the hearing the aldermen cast about for suitable language in which to couch their recommendation to dispose of the resolution in some harmless fashion. After several efforts they adopted a report which read: "Upon a full and complete hearing on the resolution it is the sense of the committee that the facts established do not warrant council action."

$650,000 Dump in Question.

The resolution demanded an inquiry into the reasons why the city had not taken advantage of an option on a quarry hole at 19th street and Lincoln avenue to be used for dumping refuse. The blame was placed upon Mr. Ettleson, with the accusation that he had not notified the council that the city must pay $650,000 award to the owners, the Chicago Union Lime Works, within ninety days after a judgment was confirmed.

The option lapsed and the city was forced to obtain dumps outside the city limits, which made the cost of disposing of refuse excessive, according to the resolution. The testimony showed that the city is now paying $1.80 a yard to dump at McCook, whereas if the dump had been bought, the cost would have been considerably less than one-half that amount. Ald. Albert declared that the city had lost $1,000,000 by the "palpable omission of duty" by the corporation counsel.

Ettleson Under Fire.

The hearing waxed hottest when Ald. Albert tried to question Ettleson concerning the latter's remark that paid emissaries, apparently referring to Eaton and Albert, were seeking to get from the city treasury an exorbitant sum of money for the dump.

Do you think State's Attorney Swanson is a paid emissary of the quarry company?" Ald. Albert asked.

"I didn't mean Swanson," Ettleson retorted.

"Whom did you mean?" Albert continued.

After Ettelson received a ruling from Ald. John S. Clark [30th], chairman of the committee, that he was expected to answer the questions of the aldermen even though they were not members of the committee, the corporation counsel replied:

"I do not choose to answer. However, I'll be glad to answer any question from members of the committee."

In his answer to the charges Ettelson referred to the vociferous remarks of one or two aldermen, apparently meaning Eaton and Albert, and the "propaganda that appears to have been artfully projected for the purpose of securing to the owners of the quarry any exorbitant and conscienceless price from the city."

Albert Makes Retort.

Albert retorted by declaring that the people are the "victims of the shrewd and cunning way some public officials do their public duty." Both he and Eaton urged the committee to pass the resolution and let the state's attorney make the investigation.

Ettelson admitted that he had not formally notified the committee by letter of the option, but named five committee members with whom he had discussed the subject.

New York Times
July 17, 1929

15-YEAR-OLD FIRE REFUSES TO GO OUT

New York Times

Riker's Island Dump Burning Despite 1,500 Gallons of Water a Minute

Back in the days when big white horses pulled the fire trucks it started and has been burning ever since Policemen of the wide-girthed, brewery era pushed back their melon helmets and watched it. Firemen poured water on it, but they could not put it out.

Then the Street Cleaning Department came along, and built a series of pipe lines to the fire, with four pumps pouring 1,500 gallons of water into it each minute. The pumps are still pumping, the gallons of water are still flowing. The fire that started fifteen years ago on the city dump on Riker's Island up above Hell Gate has not gone out yet.

This permanent conflagration has virtually become a matter of civic pride. No other metropolis in the world can boast of such a steadfast fire, a fire that has gone right through two city departments, and impinges now a third, and a fourth. It has also produced some curious phenomena, among them the following:

Item, over the the fire the accumulated dumpage has built up 140 acres of "made' land.

Item, the "made" land has become in part a market garden of quite exceptional fertility.

Item, the vegetation grows so luxuriantly that officials of the Department of Street Cleaning (which runs the pumps) suggest to officials of the Department of Corection (which runs the truck farm, in connection with the city reformatory) that tropical flora be planted there. The ground is always hot, they say, because of the peculiar fire beneath, which is almost of voting age. The ground is so hot, in fact, they say, that even the worst snow fall of the year vanishes in twenty-four hours.

But the fire is so erratic—bursting forth as it does from totally unexpected places at all hours—that the County Medical Society has complained about it. The society yesterday asked Commissioner Alfred A. Taylor of the Street Cleaning Department to do something about it. A fire that is old enough to be in high school is old enough to go out.

Commissioner Taylor called the matter to the attention of Fire Marshal Thomas P. Brophy for investigation. Patrick Hines, district superintendent of the Street Cleaning Department, called at the Municipal Building yesterday. He has charge of the four pumps. But Fire Marshal Brophy was out. Mr. Hines met some newspaper men instead.

"I wish to report a fire," he declared. And did so.

22

EXHIBIT "A"

REFUSE COLLECTION AND DISPOSAL

IN THE

CITY OF SAN FRANCISCO, CALIFORNIA

1896 TO 1928

Previous to the year 1896 little official attention was paid ne collection and disposal of the garbage and rubbish of the t . Collection was made by scavengers who were reasonably c mmodating and did not generally overcharge for the service ren- r l. The scavengers disposed of the refuse by dumping on marsh n s and in hollow areas, and dumping grounds were kept in toler- l condition by other scavengers who collected salvage from the m s and sold it to junk dealers,and who also kept the dumps from c ulating too rapidly by burning the combustible rubbish. The a h authorities kept a general supervision over conditions and l ge area was filled that is now rated as valuable property.

Most of the convenient dumping spaces were filled in the a s before 1896 and about that time it was apparent that some e method of disposal must be considered.

In February, 1896, the Board of Supervisors granted a y ars franchise to F. E. Sharon, for disposing of - by incinera- i . or by reduction - all of the refuse of the city which was d arily collected by scavengers, including condemned food o cts, swill, and dead animals.

This franchise was assigned to a Corporation, the Sanitary d tion Works of San Francisco, and the Company purchased a block g ound bounded by Rhode Island, De Haro, Alameda, and Fifteenth r ts, and, in 1897, installed thereon and put into operation I cinerator, or more properly called a Destructor, built accord- g o design using the Thackeray patents on Destructor furnaces. i s was the second, and so far as known, the last Thackeray plant i l , the first having been put up in Montreal, Canada, a year s earlier.

The Destructor has a nominal capacity of 400 tons of refuse d a and consists of thirty-two furnaces or burning cells, arranged t o groups of sixteen each. Each group has eight cells set back b ck on opposite sides of a flue to which they are connected, and th flues are connected to one chimney. Scavenger wagons deliver the f e to bins arranged over the furnaces and charging, stoking, d sh cleaning are all hand operations. For a more complete sc iption of this plant see "Engineering News," May 17, 1900, and ol ection and Disposal of Municipal Waste," by Wm. F. Morse, 1908.

To make the franchise effective, Ordinances were prepared and passed by the Board of Supervisors, making it mandatory that scavengers should deliver all refuse collected to the Destructor, and empowered the Company to charge sixty cents a ton for all refuse delivered to the plant by scavengers or others with occasional loads of rubbish. This charge, together with the sale of such salvage as could be collected and of ashes and residue from the furnaces, made up the income of the Company.

STUDY OF NEW METHODS:

With the rebuilding of the City, after the disaster of 1906, there developed a very natural desire to improve many of the conditions that existed before that time, and the subject of Refuse collection and disposal came in for its share of study. While "collection" was not considered to any conclusion, "disposal" was carried to the point of decision on the method to be adopted.

The wholesale business district was extending into the vicinity of the Destructor plant and a considerable agitation was developed to have the Destructor removed from its location or abandoned altogether.

Under the auspices of the Chamber of Commerce of San Francisco, a special committee of that body had plans prepared by the Power Specialty Company of New York and succeeded in committing the City of San Francisco to embarking on building two incinerators from plans prepared by the then City Engineer, Dr. Marsden Manson, who retained Dr. Rudolph Hering of New York as Consulting Engineer.

In 1908 the City voted a Bond Issue of $1,000,000, part of which was to be used to purchase the franchise and property of the Sanitary Reduction Works, and part to build two or more modern incinerators in different sections of the City.

METHODS OF DISPOSAL:

In 1909-1910 investigations were made by the Chamber of Commerce of San Francisco of the methods employed for the disposal of refuse in many cities of the United States, and a special committee visited a number of disposal plants. A prominent New York sanitary engineer was engaged to advise the City what was best to do, and under his supervision, and on the urgent request of the Chamber, there were drawn up specifications for two high temperature, high duty Incinerating plants of the most modern design and construction.

CONTRACT FOR PLANTS:

Bids were called for under these specifications and in November, 1910, contracts were awarded to the Destructor Company of New York, for two incinerators of the Heenan-Froude type. One incinerator was completed in the Islais Creek District and one proposed in North Beach District. The Islais Creek one was rejected after test by the City Engineer, as its cost of burning exceeded the specification requirements, and the smoke nuisance was as bad as that of the old Thackeray incinerator.

PURCHASE OF OLD PLANT:

In the meantime, in 1909, the City purchased the franchise, property and plant of the Sanitary Reduction Works for $400,000, part of the 1908 Bond issue. The Company was paid $350,000 and the balance made subject to call upon demand and release of the property.

The Company continued to operate the plant under lease, paying the City five per cent per annum on $350,000 as rental, until the latter part of 1918, at which time operating costs had increased to such a point that they were forced to demand the conclusion of the sale and full release.

The City then arranged with the Scavengers Association to retain the plant organization and continue its operation. Scavengers pay into the plant one dollar per ton for all refuse delivered and this is sufficient to pay all operating expenses and maintain the plant in good working order. Plant operation and maintenance are under general supervision of the Board of Public Works.

NEW PLANTS:

Mr. M. M. O'Shaughnessy was appointed City Engineer on September 1, 1912, and on one or two visits to the eastern states he inspected a Heenan-Froude plant at Clifton, Staten Island, in operation. The considerable difference between the refuse of the eastern cities, with its comparatively large content of coal ashes and cinders, and the refuse of this City, which contains very little coal ashes, led to grave apprehension on his part as to the successful outcome of the attempt to destroy the local refuse in accordance with the requirements of the guarantees of the contract specifications.

Because of these doubts, the Contractor was directed to complete and try out the first plant and demonstrate its success before proceeding with the installation of the second. This first plant was designed for a nominal capacity of 120 tons a day, to handle the refuse of that portion of the City situated within convenient hauling radius of its location in the Islais Creek district.

After many changes in the several mechanisms for handling refuse and ashes, most of which devices were experiments, the Contractor's test was made in September and October, 1914. The test did not convince the Board of Public Works that the Incinerator could meet the Contractor's guarantees in being free from the nuisance features of smoke, dust, and odor. The plant was not accepted and this rejection threw the settlement of the contract into the Courts. A jury gave a verdict in favor of the Contracting Company on their general plea that they had done the

best they could considering the state of the art, and that the guarantees did not mean exactly what they said. The plant was shut down and all City refuse is now burned in the old Destructor, operated by the Scavengers Association.

Your engineers visited the new Nye plant at Staten Island, constructed as a substitute for the Heenan-Froude abandoned plant.

NO SEGREGATION AT HOUSEHOLD:

There is no segregation or separation of garbage and rubbish at the household. All refuse is placed in one can which usually stands near the rear door of houses or flats or in the basement of apartment houses. The usual "garbage can" is made of galvanized sheet steel, fifteen to twenty inches diameter, twenty-four to thirty inches high and provided with a tight metal cover. The householder and apartment house owner supply the cans. Scavengers collect and deliver to Destructor about 15,000 tons a month.

Because of the total refuse being passed through the Destructor furnaces, the residue (tin cans, ashes, etc.) is large, amounting to about twenty-five per cent of the tonnage delivered to the plant. The residue is loaded into gable bottom side door cars, and hauled out over Southern Pacific Company tracks to convenient dumping places and used for filling.

SEGREGATION IN HOTELS:

While there is no separation in households, in hotels and restaurants the kitchen and table wastes are carefully separated from the general rubbish and this garbage is purchased and collected by hog raisers. This is a separate industry from that of the regular refuse scavengers, and the sale of garbage is a source of some revenue to hotels and restaurants, the prices paid during the last few years ranging from $3.00 to $5.00 a ton. At the present time the price is fairly uniform at about $3.50 a ton. Collections are estimated to be 1800 to 2000 tons a month.

COLLECTION SYSTEM:

Refuse in San Francisco is collected under what may be called the License System. Each vehicle or wagon in which refuse is transported through the streets is inspected and assigned a number by the Board of Health, for which an annual charge of $5.00 is made, and this number is plainly marked on the vehicle. Each licensed refuse collector, called a scavenger, is assigned a number by the Board of Health and is given a metal badge marked with the number assigned him. The Board of Health collects the sum of $5.00 from each collector for the expense of providing badge and for the issuance of license, against which the License Office of the Tax Collector issues an operating license which costs from $5.00 for a two horse wagon to $10.00 for a motor driven wagon of more than one ton capacity. Licenses must be renewed annually.

There are at the present time about 49 horse-drawn wagons and 64 motor-driven trucks engaged in the regular refuse collection. There are about 26 garbage trucks collecting for the hog raisers and 8 wagons collecting papers, all licensed from the Board of Health.

Scavengers operate as private individuals, own their wagon and teams and their motor trucks, and make their own arrangements with householders, markets, stores, etc., as to the frequency of collection and the charges for same.

Most of the scavengers are associated with the Scavengers Protective Association or the Sunset Association, the purpose of these associations being to work the district in a systematic and economical manner.

COLLECTION RATES:

Because of the scavengers operating independently and being under limited control by the City authorities, there was much inequality of charges for collection and a corresponding amount of complaint. To correct these abuses, and to bring the activities of the scavengers under some control, the Board of Supervisors, after much study of the rates charged and of the method of collections, in December, 1921, passed an Ordinance fixing a maximum charge for collection of refuse from residences and apartment houses, and authorized the Board of Health to enforce the Ordinance by such system of inspection and regulation as might be necessary.

An Initiative Proposition, a proposed Ordinance providing for the Collection and Disposition of Refuse, and Monthly Rates for the Collection of Refuse, was submitted to the registered voters at a special election on June 14, 1927. It received the majority vote and is now in force.

Collection is now carried on in a reasonably satisfactory manner. It is admitted that the rates are higher than they should be for a thoroughly systematic and economical operation such as could be carried on only under the most experienced and careful management of the entire collection of the whole City, but this is hardly possible in the present condition of individual and separate ownership of collection equipment.

SCAVENGER WAGONS:

Both horse-drawn and motor-driven wagons are of the back end dump type. The older wagon bodies - the horse-drawn - are of wood with heavy steel trimmings and have a capacity of 6 to 10 cubic yards. The motor bodies are generally of steel plate and have capacities up to 13 cubic yards. The average daily tonnage per load is 3.53 tons. Some of the motor wagons make two deliveries a day to the Destructor. The horse-drawn wagons seldom make more than one delivery.

REDUCTION PLANTS:

During the past twenty-five years, two or three small reduction plants, in connection with slaughter house and fertilizer works, have been tried out for the recovery of grease and tankage from garbage, but none have been financially successful.

DUMPING AT SEA:

Acting under authority of Resolution adopted by the Board of Supervisors, and which became effective February 5, 1927, specifications, drawings, and proposal specifications were prepared for the proposed collection and disposal of the refuse of the City by dumping the same at sea.

Several meetings were had with the officials of the State Harbor Commission and several sites for a Refuse Loading Wharf were considered and discussed, the decision and agreement finally resting on the proposed site at northerly end of Ingalls Street as being the most acceptable and convenient, and the one the Harbor Commission intimated that they would approve as a site upon which the City could install the loading wharf and pier approach from Ingalls Street. The City was to build the wharf and pier; the Harbor Commission was to charge the City a rental per year and would dredge and keep open the channel to the wharf without further cost. Dockage and tolls were to be charged for each ton of refuse loaded.

The preliminary estimate of cost included the loading wharf, the pier from Ingalls Street shore line and the complete loading equipment. The estimated fixed charges on the estimated costs were for an assumed operating period of ten years.

It was recommended that the Board of Public Works approve the specifications, proposals, and drawings, and transmit to the Board of Supervisors for further action.

At a meeting of the Joint Finance and Health Committee of the Board of Supervisors it was decided and directed that further investigation be made of possible sites for Refuse Loading Wharf as alternatives to the proposed site at Ingalls Street. As a result of the investigation the estimated costs of four alternative proposed locations for refuse loading stations, with Fixed Charges and Operating Charges based on disposal of 15,000 tons a month or 180,000 tons a year, were prepared.

The Board of Public Works approved the above estimates and drawings of the four alternative locations April 29, 1927, and transmitted same to the Board of Supervisors for further action.

The Health Committee of the Board of Supervisors at a meeting on the 15th of September, 1927, directed the City Engineer to prepare specifications and proposals for a contemplated contract to be

made for disposing of the refuse of the City by dumping at sea, and further supplement the previous reports by submitting proposed new or modified specifications and proposal, to conform to details of policy as requested by the Committee.

The Harbor Commission referred the Committee back to sites suggested, located at the northerly end of Ingalls Street or the northerly end of Keith Street.

The owners of the Water Front Land Company, who held a McEnerny title to the land lying between Evans Avenue and the shore line adjacent to Islais Creek, since acquired by the Great Western Power Company, protested the proposed use of Ingalls Street north of Evans Avenue. These several actions served to limit the possible site for a loading wharf to the Keith Street approach, excepting for the possible development of some permissible site under the terms which were proposed in the specifications, wherein the contractor for disposal at sea might arrange to supply or secure his own loading wharf and equipment.

The Board of Public Works approved the supplemental report October 5, 1927, and transmitted the same to the Board of Supervisors for further action.

Several proposals to take refuse to sea and dumping, were received by the Health Committee during the year of 1927, but to date no action has been taken on recommendation.

SANITARY FILL:

Several proposals to dispose of the Refuse of the City by dumping in the tide-land and low-lying ground areas, as a temporary method for a year or more, were received by the Health Committee during the year 1927. With each proposal the contractor agreed to furnish bond and would guarantee to keep the dump free of rodents, vermin and flies, and, in general, in a condition as sanitary as possible, by totally covering each day's fill completely with the equivalent amount of earth.

Property owners and residents in the vicinity of proposed fill areas were emphatic in their objections against this method of Refuse Disposal. The Board of Health now, as in the past, and also the City Engineer, stand opposed to such a method of disposal for any length of time, as being a menace to the life and health of our citizens. They claim it would adversely affect commerce and industry and will entail, if plague infestation results, a serious economic and a tremendous cost to eradicate.

INCINERATION:

There was filed in the Superior Court on October 4, 1926 -- Judge E. P. Mogan -- a suit asking for an injunction against the further operation of the Destructor and relief from the general nuisance of the plant in its present location. At one of the early

sessions, Supervisor McSheehy on the witness stand said that the Destructor was a nuisance, and something should be done about some other means of refuse disposal.

The Health Committee held many meetings during the year 1927 at which different methods of disposal were presented and discussed, and the Board of Supervisors directed the City Engineer to make investigations, prepare plans and estimates and specifications for loading wharf and equipment and call for bids for a contract to take the refuse of City and dispose of it by dumping into the Pacific Ocean.

Because burial at sea was recognized to be more or less a temporary method of disposal and the sanitary fill method was viewed with grave apprehension by the health authorities, gave cause for the Committee to investigate incineration as a final method of disposal for the City's refuse.

There have been, from time to time, suggestions for trying to improve the operation and capacity of the old Thackeray Destructor at 15th and De Haro Streets, but none has seemed of sufficient value to recommend its adoption.

The design and construction of the old furnaces and flues are not of such nature that they can be improved in any practical or permanent manner. The design is obsolete and the physical condition is such that to make a practicable improvement would mean removing the entire plant -- excepting possibly the chimney which has been there more than thirty-two (32) years -- and building a new incinerator of modern design.

To relieve the situation it was suggested that some use be made of the abandoned Islais Creek Incinerator and the property adjoining owned by the City, and at the request of the Health Committee of the Board of Supervisors plans and estimates were made and delivered to them for a proposed incinerator that would fit in to some advantage with present conditions.

The proposed Incinerator consisted of four pairs of the circular type of furnaces with domed arches, each pair with its combustion chamber and flue. One large chimney for each two pairs of furnaces set on opposite sides of plant. The estimated capacity of these eight furnaces was 400 tons in 16 hours, or approximately 700 tons a day, making due allowance for time needed for clinkering and cleaning fires.

This recommendation was approved by the Board of Public Works March 14, 1928, and was transmitted to the Board of Supervisors for consideration and disposal. The Health Committee met April 5th to consider this recommendation, but came to no agreement. The Clerk was instructed to put notice in all papers of a general meeting on April 24th to consider location and to hear protests on proposed Incinerator. Several hundred protestants were present at this meeting, representing Improvement, District and Civic Clubs; Parent-Teachers and Merchant Associations; representative of Episcopal Church and property owners. Many written protests were filed

th the Clerk before the meeting. Speakers voiced their protests
the applause of sympathizers. One proposal - 600 tons per day
sea -- 10 years and two proposals -- fill and cover, one year or
re were read by the Clerk.

During the latter part of May, 1928, Chairman Toner, of the
alth Committee, made a trip East lasting about a month, and during
at time he visited disposal plants in the East, Canada, Middle West,
d the South. He was present at the opening of the New Superior
ant in Chicago, and on the way home visited a number of plants
similar design in Texas; but made no detailed report of his
servations.

At a meeting of the Board of Supervisors, October 8, 1928,
e Health Committee requested leave of absence for a trip to visit
l of the incinerators in the country. After some opposition by
her Supervisors, an appropriation to cover expenses and 60 days
ave of absence was granted. Though suggested by some members of
e Board that a qualified engineer go with them, they went without
, because one of the Committee said, "We do not want to be
pered."

Supervisors' meeting November 5, 1928, Chairman of Health
mmittee read report on result of investigation of United States and
nada incinerators; named cities visited, methods of disposal,
duction, sanitary fill, incineration, and types of incinerators.
oked into the collection system - municipal and contractor -
riations in collection and disposal. Had engineering advice at
l cities - probably from the engineering department of each one.
asked for 90 days in which to prepare the final recommendation
the Board of Supervisors.

Chairman outlined what the Committee would have to investi-
te before it could make recommendation: the number of incinerators;
e locations; method of financing; possibility of private parties
ilding and operating plant or plants. They had not yet decided
the type of incinerator to recommend; whether to dump at sea, or
fill and cover while building a new plant or plants. They have
mass of data to look over and to decide on what will best suit
nditions here, and they intend to look into the collection and
sposal here and compare with Ordinance now in effect. Chairman
osed by stating the conditions here are entirely different from
se of any other city visited, but he felt confident that in
days, or before, the Committee would have its recommendation
dy for the Board.

EXHIBIT "B"

Progressive Report of Health Committee on Investigation of Garbage Disposal System in Various Cities.

The following was read by Supervisor Toner, ordered *spread at length in the Journal and copies sent to members*:

San Francisco, California, November 1, 1928.

Honorable Board of Supervisors.

Gentlemen: Your Health Committee hereby presents the following progressive report as the result of our investigation in the different cities of the United States and Canada in connection with the question of garbage disposal and its relation to conditions in San Francisco:

Prior to the year 1896 all garbage collected in San Francisco was disposed of by what is now known as the Fill and Cover Method. In that year an incinerator was erected on the block bounded by De Haro, Alameda, Rhode Island and Fifteenth streets, by a private corporation. This incinerator was of the Thankeray type, with a 300-ton capacity. At that time the population of San Francisco was such that this incinerator easily disposed of the garbage. Today the population has doubled, and we find that this incinerator is called upon to incinerate 600 tons daily, which is impossible.

In the year 1908 a bond issue was authorized for the purpose of erecting modern incinerators in our city. A Heenan & Freud type of incinerator was erected on the land south of Army street, between Kansas and De Haro streets, costing:

Land	$ 15,000
Building and equipment	377,704

This latter sum is a total loss to San Francisco, on account of failure of the incinerator to properly function. This plant is abandoned and equipment diverted to other purposes. As to rehabilitation of this plant for further incineration purposes, our final report will deal with this matter. A second incinerator was planned for the North Beach section, and a site purchased on which $144,679 was expended. Of that sum $80,000 was for land, the balance for plans, surveys, etc., amounting to $64,679, of which the latter sum is a total loss. The sum of $407,130 was expended for the purchase of the present incinerator, including land at Fifteenth and De Haro streets, which also covered interest and legal expenses, or, in other words, the City of San Francisco today, after an expenditure of $946,514 for garbage incinerators, has only to show a part of a block on Army and Kansas streets valued at ..... $ 15,000

Lot at North Beach	80,000
Fifteenth and De Haro property and equipment	350,000
	$445,000

Subtracting the $445,000 from the original bond issue of $946,514 leaves a net loss of $501,514.

An injunction suit was instituted in the superior courts two years ago for the purpose of condemning the Fifteenth and De Haro streets incinerator as a public nuisance. The courts have shown leniency to the city by thus far withholding their decision, thereby giving the city an opportunity to abate the nuisance. Your Health Committee, realizing the seriousness of the situation and the mistakes made in the past, have made investigations throughout the United States and Canada for the purpose of recommending a proper disposal of San Francisco garbage.

Exhibit "B"-2

The following cities were visited by your committee, and different methods of garbage disposal studied, as follows, viz.:

Chicago—Fill and cover reduction plant and a new Superior incinerator, 600-ton capacity.

Evanston, Illinois—Disposal by incineration—Superior type.

New York—Borough of Manhattan: Dumping at sea—fill and cover and incineration of the following types: 1 De Carie, 300 tons; 20 Sterling, 300 tons each. The Borough of Queens: Consists of the following subdivisions: Mineola, N. Y., Nye incinerator; Freeport, N. Y., Borge Elleson incinerator; Rockville Center, N. Y., De Carie, 325 tons; Staten Island, N. Y., Nye; White Plains, N. Y., Nye.

Washington, D. C.—Disposal by reduction plant.

Also visited the United States Department of Public Health, and found this department has no data and no standardization of garbage disposal.

Boston—Reduction works on island in Boston harbor. State Engineer of Massachusetts recommends incineration for Boston and vicinity.

Providence, R. I.—De Carie incinerator, 160 tons.

New Bedford, Mass.—Superior, 100 tons.

Montreal—Fill and cover, and are making plans for incineration.

Outremont, Canada, near Montreal—De Carie.

West Mount, near Montreal—Heenan & Freud.

Toronto, Canada—Two Sterling plants, 400 and 200 tons each.

Cincinnati—Fill and cover. Asking bids for incineration.

St. Louis, Mo.—Coder incinerator, abandoned fill and cover and hog feeding.

New Orleans—Two De Carie incinerators and fill and cover, building two Sterling.

Houston, Texas—Two Superiors.

Fort Worth, Texas—One Superior.

Dallas, Texas—One Superior.

Galveston, Texas—Assembled plant.

El Paso, Texas—Fill and cover.

Portland, Oregon—Nye and fill and cover.

Seattle—Fill and cover.

Tacoma—Fill and cover.

Salt Lake City—Fill and cover.

Sacramento—De Carie.

Oakland—Dumping at sea, 300 tons daily.

Berkeley—Fill and cover.

Long Beach—Fill and cover. Plans are being prepared for incineration.

Los Angeles—Hog feeding and Nye, 800 tons.

Beverly Hills—One twenty-ton Nye.

In all our inspections in the cities above mentioned we had the benefit of expert engineering advice from the city engineers and others in charge of actual operation of plants. We also investigated the different methods of collections of garbage and found in all cities that collection and disposal were under municipal control. In most cities we found a great variation of cost in collection and disposal.

We have in our possession reports covering the experience of 200 cities in the United States showing cost and methods of garbage disposal. Your committee has communicated with and have reports from Berlin, Vienna, Hamburg, Paris, Bordeaux and Liverpool on the above question. In all our investigations, both in the United States and Canada, and by correspondence in Europe, we find incineration is the scientific method being adopted and all other methods abandoned. Before submitting our final report, your Health Committee will study and make recommendations on the following subjects:

1. Ordinance governing the collection and disposal of garbage.
2. Location of incinerators.
3. Advisability of building one or two incinerators in different parts of city.
4. Method of financing the building of the said incinerators.
5. Type of incinerators to be erected.
6. Disposal of garbage during the building of incinerators.

The Committee will make its final report covering the above-mentioned subjects in ninety days from date.

HEALTH COMMITTEE.
(Signed) DR. J. M. TONER.
J. EMMET HAYDEN.
J. B. McSHEEHY.

EXHIBIT "C"

April 29, 1929.

Report of Committee on Public Health in re Garbage Disposal.

To the Honorable Mayor and Board of Supervisors of the City and County of San Francisco.

Gentlemen: Your Public Health Committee respectfully submits the following report:

In placing before your Honorable Body a report of our study of the garbage situation in San Francisco, we are cognizant of the fact that we are dealing with a problem that has been unsuccessfully wrestled with by our predecessors and is a very serious economic and sanitary question for San Francisco.

Your Committee has searched out all available information, has heard every proponent and every protestant of every conceivable garbage collection or disposal plan; has visited and inspected the plants of American cities; has gathered information relative to European garbage problems through correspondence, and has exhausted all means of information before venturing to render this report.

The reason these extraordinary measures were taken is due to the fact that the problem is so deep and so vital to the health of the City that we have stopped at no effort in our search after a plan which will forever solve this problem, so important to San Francisco, because San Francisco, at the gateway of the Orient and world commerce, has a particularly difficult sanitary problem.

An adequate report which would explain every phase of this subject would contain volume after volume, more than your Board could peruse in a term of office. Therefore, in order to relieve this Board of the task we have selected the systems most successful for the disposal of garbage in other cities, and we report them to your Honorable Board.

I.

Garbage Collection.

Your Committee makes no recommendation on garbage collection but reserves its report until the Bureau of Governmental Research shall have reported the results of an investigation now going on. This will be the first unbiased and scientific information this Board has ever received on garbage collection.

II.

Garbage Disposal.

The following are the methods used in garbage disposal:

1—Dumping at sea;
2—Reuction process;
3—Fill and cover;
4—Incineration.

After a careful study of the above methods as applied to San Francisco, your Committee finds incineration the most sanitary and most efficient means of ridding the City of its refuse. Incineration is being adopted by most cities of this country as well as Europe and South America.

III.

(A) *Location.*

We recommend that the incinerator be built upon the site at Fifteenth and De Haro streets now owned and used by the City for this purpose. The above described lot is 200 by 400, which is sufficient ground for the erection of a modern incinerator. Furthermore, the aforesaid site will obviate unnecessary expense, realty difficulties, and the possibility of protest against locating an incinerator upon a new and untried location. This locality is sufficiently central to cut the hauling cost, which is an important factor in garbage collection. It would be difficult to find a more practicable site for an incinerator than on the land owned by the City at Fifteenth and De Haro streets. The cost of the purchase of another lot which would meet with the approval of the public would add an unnecessary expenditure.

Exhibit C-2

(B) *Operation and Financing of Incinerator.*

Your Committee believe that an incinerator is and should be classed as a public utility, and that as our Charter commits our City to the acquisition and ownership of its utilities, that the incinerator should, if possible, be publicly owned and operated. The only objection to this plan is the obtaining of the necessary funds to carry out the construction. We deem it neither possible or advisable to visit upon the taxpayers in any one year the cost of construction, and, therefore, the only alternative to effect public construction would be a bond issue. Owing to the present conditions in the municipal bond market there are grave doubts in the minds of the members of your Committee as to whether it is feasible at this time to float a bond issue at a reasonable rate of interest, and as the need of the incinerator is urgent, and cannot await the improvement in the bond market, we believe that the interests of the City would be best conserved, and the public ownership provisions of our Charter adhered to, by permitting this incinerator to be built by private capital, giving to the builder the right to operate it for a definite period of years, with the definite understanding that the City might take it over at cost, less a fair depreciation, at any time during or at the expiration of the period. This plan might or might not carry with it the exclusive privilege of collecting the garbage as well as the privilege of incinerating it. The plan indicated would give to the City the right to become the owner of the plant at any time that a bond issue for the necessary amount would be deemed advisable, or other suitable financial arrangements would be made to produce the required cost. The plan of permitting private capital to construct the incinerator should provide for its construction upon the City's lot above mentioned, and should include a reasonable rental to the City for the use of the lot. We most respectfully recommend that no proposition looking to the construction of the incinerator by private capital be considered unless it contains both definite and fair provisions regarding the retaking of the plant by the City whenever it is deemed advisable to do so.

(C) *Type of Incinerator.*

The following are the fundamental requirements for a suitable incinerator:

1. An incinerator must have good general conformation and architectural design, good workable conditions, and require a minimum amount of labor.

2. The plant must destroy rubbish and garbage in a sanitary and inoffensive manner, with complete destruction at minimum cost. If an incinerator is insanitary and offensive it fails in its principles and is a total loss. For that reason the initial cost is not altogether the determining factor.

3. The furnace of the incinerator must preferably be of brick type, according to the best engineering counsel, thus giving better radiation.

4. The plant must be such that there will be no interference or delay in the collection of refuse or in delivering it to the plant. The cheapest plant to operate and keep in repair is one which has a uniform, regulated operation. Mechanical feed and automatic hoppers are therefore essential.

5. The incinerator must be equipped with shaker grates, the latter preventing clinkers. Clinkers are the bane of most incinerators. The shaker grates should operate over an ash pit with a special drop for cans and noncombustible substances.

6. A single-cell furnace fails of efficiency for want of mutual assistance; for that reason a four-cell furnace is preferable, and the Committee recommends it, as we feel that the mutual assistance type is of great help in the complete destruction of garbage.

7. The baffle wall is another important requirement of the good incinerator. The baffle wall increases the efficiency of a furnace by changing the direction of the flow of the gases, which breaks stratification, thus greatly increasing the distances the gases must travel, so that those gases are retained for a longer period. Great additional heat is utilized by the retention of the gas.

Your Committee has found the type of incinerator built by the city of Chicago in 1928 to embody the above-described qualifications, and a model for modern refuse burners.

The accompanying specifications were provided through the courtesy of the City Engineer of Chicago, Mr. L. Gayton. These are the major specifications for the incinerator which we recommend for San Francisco. Definite engineering recommendations are attached for the information of the Board.

Your Committee recommends that whether the City constructs the incinerator itself or permits it to be private constructed, that a plant embodying the above-mentioned features be adhered to, for the reason that we believe that the features mentioned are absolutely necessary from both a sanitary and economical standpoint.

Exhibit "C"-3

IV.

Temporary Garbage Disposal Pending Construction of an Incinerator.

Your Committee, after thorough investigation, recommends the adoption of the fill and cover method of disposal of the City's refuse until the incinerator plant be built. It is estimated that it will require a year to complete the plant.

Examinations of fill and cover operations in Seattle and other cities where it is utilized convince the Committee that it will solve an emergency condition in San Francisco.

Several fill and cover projects were considered by the Committee, but only that of the Industrial Land Developing Company contained the necessary safeguards against insanitary conditions and fill the health requirements of this Committee and of those other communities wherein fill and cover projects are now in operation.

(A) *Education.*

The garbage must not be dumped where it will menace the health of homes in the vicinity, nor must it be dumped too far from the city for garbage hauls. Should a site be selected too far out it would increase the cost of garbage collection.

The garbage must not be dumped close to any food supply of the City, because of the possibility of contamination before the refuse can be covered. If all of these requirements are strictly observed your Committee believes the investigation of fill and cover proves that it can be used temporarily to dispose of the waste of San Francisco.

The Board of Supervisors has recently recommended reclamation of this district. The Industrial Land Developing Company has agreed to grade Donohue street from Hunters Point to the proposed site for fill and cover. This will eliminate the necessity of the garbage wagons going through the residential section of Bayview.

For these reasons the site selected by the Industrial Land Developing Company at Hunters Point appears to be practical.

(B) *Safeguards.*

It is imperative that the fill and cover contractor be required to own the land upon which he proposes to dump the garbage, and that the primary purpose of such contractor be construction of new land for building purposes rather than mere profits from garbage disposal.

In the latter case the contractor will naturally endeavor to fill and cover as cheaply as possible, in order to make a profit. In the case of the owner of land utilizing the garbage to create new land for building purposes, it is clear that the garbage must be buried deeply, so that the land will be sanitary and marketable.

No municipal restriction will prove one-half so efficient as the necessity of making marketable land, in the opinion of your Committee.

The fact that the Industrial Land Developing Company proposes to create new industrial land sites for San Francisco out of land filled with garbage off Hunters Point, prompts this Committee to recommend they be given the franchise.

We recommend that this Board grant the Industrial Land Developing Company said franchise to fill and cover land at Hunters Point according to plans and specifications presented by them to this Committee and now in the possession of your Board, for the sum of one dollar per ton, said franchise to be revocable when the incinerator shall be built and ready for operation.

Exhibit "C"-4

Propositions.

Saltelkan Engineering Company, 605 Market street, Sutter 2033:

Erect vacuumizer retort, present location. Twelve units. No cost to city. Retort to cost $900,000; revert to City after twenty years. City may buy plant during life of franchise by paying $900,000, minus depreciation. Pay rent on property valuation. One dollar per ton for incineration.

Leopold Lange, 905 Sutter street. Two propositions:

1. Reconstruct present incinerator. Five-year contract. Meantime erect one unit Lange model incinerator.

2. If satisfactory, erect entire plant, to cost $1,000,000, on a fifty-year franchise. At end of fifty years revert to City. City may buy plant during life of contract, less depreciation. Plant to be erected on City property, Fifteenth and De Haro streets. No rent paid to City. One dollar per ton for incineration.

R. W. Lawton, representing Nye Incinerator Company:

Will build 600-ton plant at company's expense in return for franchise of twenty-five years, after which period it reverts to City. $1.50 per ton for incineration. Build on City property. Rental $1 per year.

Wm. Hirsch, Ludwig incinerator, 960 Natoma street, Underhill 2851. Two propositions:

1. Erect two 400-ton Ludwig incinerators on lot furnished by City with spur track facilities. Twenty-five-year franchise at $1 per ton. Plant to revert to City after twenty-five years. No rent.

2. Build two 400-ton Ludwig incinerators on City lot. Fifteen-year franchise. Company to operate incinerators six years. City to have privilege to buy incinerators at end of six years. Pay cost for incinerators with interest on investment, minus depreciation. Cost of plant, $1,000,000.

Steam Shovel and Trucking Contractors, 74 New Montgomery street:

Fill and cover on tidewater land at South Basin. Permanent or temporary. Will cut Donohue street through so as to prevent wagons going through residential section of Bayview. Process to be conducted in sanitary manner. Charge, $1 per ton.

Tide Land Reclamation Company, T. E. Treacy, president:

Fill and cover in South Basin territory, neighborhood Carroll and Ingalls streets. Permanent or temporary. Process to be conducted in sanitary manner. Will take garbage to dump in steam cars, street cars or trailers.

Scavengers' Protective Union, Inc.:

Build incinerator on City property, Fifteenth and De Haro, approximately $1,000,000. Type to be chosen by City. Revert to City after twenty-five years. Pay rent on fair valuation of property. City to have right to buy plant any time during life of franchise at cost of plant, minus depreciation.

Adolph Uhl:

City to condemn 1200 acres of land in South Basin in units of 100 acres per year. City to build four receiving stations for garbage:

1. Foot of Powell street.
2. Geary and St. Joseph's, adjoining cemetery.
3. Ingleside District.
4. Tenth and Bryant street.

Garbage to be dumped in receiving stations in day time. At night loaded on municipal gondola cars, hauled to dumping ground and covered with dirt. Dumping maintained in a sanitary manner.

Capt. George W. Beers, 815 O'Farrell street, Ordway 3241:

Taking garbage to sea twenty-five miles. City to furnish docks, to cost approximately $60,000 to $100,000, depending on location. $1 per ton. Franchise to run two to three years. City to guarantee delivery of 15,000 tons per month. Company to furnish two ships, either capable of handling entire monthly output.

J. J. Henderson, 620 Mills Building. Two propositions:

1. City to build wharf and furnish equipment at cost of $190,000. Give company five-year franchise at 87½ cents per ton.

2. Company to build wharf. Receive a ten-year franchise at $1.20 per ton. Garbage to be dumped twenty-five miles at sea.

Respectfully submitted,

COMMITTEE ON PUBLIC HEALTH,
DR. J. M. TONER, Chairman;
J. EMMET HAYDEN,
JAMES B. McSHEEHY.

X - 1060
7/25/29

Exhibit "D"

REFUSE DESTRUCTORS

AN INVESTIGATION
MADE UNDER THE DIRECTION OF
COL. A. A. SPRAGUE
COMMISSIONER OF PUBLIC WORKS

By

LORAN D. GAYTON, Member A.S.M.E.
GEORGE B. ROBINSON, C.E.

CITY OF CHICAGO

In Two Parts

PART I

June 2, 1925.

Hon. A. A. Sprague,
Commissioner of Public Works,
Chicago, Illinois.

Dear Sir:

In connection with an investigation of present day waste destructors, you requested the writers to visit a number of cities where incinerators were in operation and secure reliable information as to the relative merits of the different designs.

Pursuant to the above request, we left Chicago on Monday, May 4th and visited the following municipalities:

Charleston, W. Va.
Washington, D.C.
Philadelphia, Pa.
New York City, N.Y.
Patterson, N.J.
White Plains, N.Y.
Toronto, Canada
Milwaukee, Wis.

In each of the above cities, with the exception of Washington, D.C., we studied the design and operation of the incinerator in use, interviewed the officials in charge, and where possible, secured drawings and specifications covering the design of the furnaces.

We returned to Chicago from Toronto on Saturday, May 16th and on Tuesday, May 19th, spent the day in Milwaukee, inspecting the plant there. Previous to visiting these cities, we, in company with yourself and Mr. Byrne, Superintendent of Streets, investigated the incinerator at Evanston, Illinois.

In each of the cities visited, we were shown every courtesy by those in authority and given every opportunity to study the plants under their control.

In the following report we have set down in detail our impressions of the various plants studied, and recommendations based upon our investigations.

A STUDY OF REFUSE DESTRUCTORS

CHARLESTON, W. VA.

The incinerator was installed by the Balmer Corporation of New York City and has been in operation since September 1923.

There are two units, each unit having three grates. Each unit was designed to burn 35 tons of mixed refuse in 24 hours, making the designed capacity of this plant 70 tons per day. It has been operated at 90 tons per day.

The material was being delivered separately - garbage in one truck and boxes, paper, etc., in another. As it was the yearly Clean-Up Week, a great deal of combustible material was being received. In some grates green garbage with very little rubbish was being burned. The furnace was handling this wet material very satisfactorily. Tin cans and bottles were mixed with the garbage. After burning, the refuse left is fine ash, soft tin cans and some fused glass.

Each unit is revised by an individual storage bin, into which the refuse is discharged through hatchways from end dump trucks which follow a direct line of travel into and out of the building. The storage bins are placed above the furnaces and are made of steel and concrete. The bottom of each bin is inclined forward, and forms the top of a hot air chamber which is heated by radiation from the combustion chamber of the furnace.

The theory of this arrangement is that the garbage in the storage bin will become heated and ferment, and distill off combustible gases which are drawn off by the forced fans and utilized with the air supply for maintaining and intensifying combustion on the fire grate.

At Charleston the garbage does not remain in the storage bins long enough to ferment and give off any combustible gas and the hatchways are kept open so much that if gas were forced, it would escape.

It would seem that in practice, this idea of heating the garbage to the point of fermentation might be neglected and that greater efficiency could be gained by insulating the furnace, thus stopping the loss of heat by radiation outward and increasing the radiant heat inside the furnace.

Each storage bin is provided with a drain in order to remove as much moisture as possible before the refuse is placed in the furnace.

From the storage bin the refuse is raised through a vertical guillotine door to the furnace feed hopper and from this hopper is discharged downward on the grate.

Each unit or battery is composed of three grates under a common arch. The grates are of the fixed type with bars set close together and are surrounded at the sides and rear by a cast iron box which is air cooled.

The products of combustion on the grates pass through two openings in the rear wall to the combustion chamber. At this point the design calls for superheated air to be forced by jets into the gases, but at Charleston this is not done. We consider this secondary air supply one of the outstanding features of this particular incinerator, and if properly used, should greatly increase the efficiency of the plant.

The combustion chamber is divided into three passes. In these passes, by the use of baffle walls, the direction of the gas travel is changed and slowed down, stratification is prevented, the gases are mixed, complete combustion takes place and all dust and cinders are deposited. Although the furnaces were burning heavy charges of a mixture of wet garbage and rubbish, there was only a trace of whitish smoke emerging from the stack. An inspection of the combustion chamber showed a clear cherry red, indicating a temperature of around 1800° F. There were no disagreeable odors around the plant. The ashes are raked from the grates into cars, wheeled to a skip hoist, then to an overhead hopper. From the hopper the ashes are taken by wagon to low land dumps.

Outside the main building between the gutter and the chimney, an animal crematory is installed. The hot gases from the furnace are by-passed through this crematory, and with the aid of supplementary air supply from the fan, the cremation of horses, mules, cattle and smaller animals is accomplished.

Drawing 9061 shows temperature in the first pass of the combustion chamber during a test run. A temperature of 1250° F. is required to eliminate obnoxious odors, and the chart shows that temperatures well above this were maintained.

Drawing shows the general design of the Balmer furnace. This furnace is well designed from a combustion standpoint. The grate areas are properly proportioned, provision is made for long gas travel, and the combustion chamber is large enough to handle heavy overloads.

This furnace is doing fine work at Charleston, but in our opinion the installation of an air preheater in the gas flue to preheat the forced draft air to about 400°F. would still further increase the efficiency and enable the incinerator to burn refuse with a smaller percentage of combustible.

This furnace was designed to burn 30% combustible and 40% garbage. When we inspected this destructor, it was burning 50-50 and combustible was coming in at such great quantities that some of it was being turned away and burned at the dump. The furnace will handle the percentage for which it was designed.

The operating force under Mr. J. H. Cain, Superintendent of incineration, consists of the following:

1 Laborer dumping trucks
3 Laborers feeding furnaces
1 Laborer stoking furnaces

We are indebted to Mr. Cain and to Mr. H. L. Campbell, City Engineer, for permission to study this plant.

WASHINGTON, D. C.

Mr. Cain, Superintendent of Incineration at Charleston informed us that there was a very efficient incinerator in Washington, but on arriving there we found it was used to burn refuse only, the garbage being handled in a reduction plant.

PHILADELPHIA, PA.

This is a Sterling Destructor, built by Bartlett & Snow of Cleveland, Ohio. It has been in operation several years. There are four units or batteries, each unit designed to burn 70 tons of mixed refuse (65% garbage, 35% rubbish) or 120 tons of rubbish. This makes the designed capacity of plant 280 tons of mixed refuse or 480 tons of rubbish. There are four grates to each unit, each grate having an area of 25 sq. ft., or a total of 100 sq. ft. per unit.

From the above it would indicate that the plant was designed to burn 57 lbs. of mixed refuse per sq. ft. of grate area per hour. There are two stacks, one stack serving two units. The cost of this plant was $600,000.00.

The majority of the material is delivered in end dump wagons. The wagon backs up against a guard rail at the edge of the dumping floor and deposits its contents on the charging floor about 10 feet below. The garbage is dumped in one location and the rubbish next to it, making alternate piles. On the charging floor the material is raked in the proper proportions of garbage and rubbish into the charging hopper directly over the furnace.

Each charging hopper holds about 400 lbs. of mixed refuse, and there are four hoppers to each unit. These hoppers are kept filled all the time. At the bottom of the hopper is a sliding door operated by a pneumatic air cylinder. The man below on the firing floor pulls a chain connected with a two-way valve which moves the sliding door and drops the charge into the furnace.

The door is then closed and the hopper is again filled by the man above on the charging floor. About every five or six hours the ashes and clinkers are raked off the grate and dropped through an opening in the firing floor into an ash car below. From here they are wheeled outside the building and deposited on low ground or hauled away by wagons.

A study of the plan of this particular furnace will show that in general the design is good, and if properly proportioned should give satisfactory results. The four grates are under one arch, so that if the fires in the individual grates are alternated, the radiant heat from a hot fired grate should help to ignite and develop the newly started fire on another grate, and should help to maintain a uniformly high temperature in the entire furnace. The travel of the gases is in a straight line over the four grates; they then turn 180° and pass into the combustion chamber. The gases then pass upward thru an air preheater, giving up part of their heat to the air from the forced draft fan onto the stack.

At the time we visited this plant they were having annual clean-up week in Philadelphia and much more rubbish than garbage was being delivered at the incinerator. The rubbish included a great deal of metal, tin cans, ashes, etc., which could not be burned, and required hauling away. Dense black smoke was coming out of the stack, and the entire plant was more or less filled with smoke.

We were unable to secure a plan of this furnace giving dimensions. A great deal of smoke was coming out from the firing doors, which may have been caused by the dampers not being opened enough for the amount of material being burned or from carrying too high a forced draft pressure. Considerable smoke and flame were escaping from around the doors in the bottom of the charging hoppers and at times material would lodge on top of the furnace brickwork and ignite.

This furnace has a drying hearth 18 inches wide in the rear.

Considerable unburned material remains lodged on this ledge and when the fire is cleaned this unburned refuse is raked out with the ashes.

The operating force at the time of our visit was as follows:

1. Superintendent
1 Weighman
16 On charging floor (1 to each hopper)
8 On firing floor (stokers)
3 In ash tunnel handling ash cars
2 Wagons hauling away ashes

Altogether this plant was operating in a very unsatisfactory manner. The operating force seemed poorly trained with no idea of how to control the different parts of the equipment in order to secure desired results.

In other cities the same design was very efficient. How much of the poor results being obtained here may be charged to poor design and how much to poor operation, it is hard to say but we are of the opinion that supervision and untrained labor are at fault in Philadelphia.

An interview with the officials in charge of the Department of Waste Disposal, Mr. Soby, and his assistant, Mr. Nuttal, at the City Hall in Philadelphia, seemed to indicate that they were more interested in garbage reduction than in incineration, and were making no effort to make a success of the incinerators. Both of these gentlemen are experienced in waste collection and disposal.

NEW YORK CITY

This plant, located at 56th Street, near the Hudson River is of the De Carie type, and has been in operation about one yea There are six units or batteries, each designed for 50 tons of mixed refuse (60% garbage, 40% rubbish), making this a 300-ton plant. The Chief Operating Engineer claimed they had burned 500 tons in 24 hours. One stack 9'6" at top and 250' high serves the entire plant. This stack was lined only about two-thirds of its height. At one time the plant was closed down to make repairs to stack lining. The outside brickwork is cracked and is now held together with steel bands.

The material is delivered in end dump trucks, garbage and rubbish separate. After being weighed the truck passes up a winding ramp into the building to the dumping floor, backs up to a curb at the edge of the dumping floor and dumps its load upon the charging floor about eight feet below. Garbage and rubbish are dumped into separate piles. On the opposite side of the dumping floor there is a storage space for about 200 tons garbage and the same amount of rubbish in separate bins. When stored the garbage is placed in large boxes and these are piled three high for the next shift.

The entire dumping floor is served by an overhead trolley system with a travelling electric hoist. This hoist stacks the garbage boxes and transfers the garbage or rubbish from the storage piles to the firing floor as required.

The refuse on the firing floor is raked into the charging hopper in the proper proportions of garbage and refuse. The charging hoppers are directly over the furnaces and by pulling a chain the fireman below on the firing floor operates a gate and drops the charge into the furnace.

The DeCarie furnace is really not an incinerator. It is a special type of steam boiler designed to use refuse as a fuel. From the charging hopper the material drops onto what is termed a basket grate, where it is supposed to dry out before dropping onto the main grates below; this basket grate is simply a system of pipes containing water and connected into a boiler circulation. The pipes are close together to support the refuse while drying out. After the material has dried out on the basket grate the fireman rakes it down to the main grate below. On this grate the material is burned, the gases passing up thru the basket grate, drying out the refuse there in and heating the water in the pipes and thus generating steam. After the material is burned the fireman dumps the main grate, depositing the ashes into an ash pit below. Ash cars take the ashes from these pits to wagons, which remove them to dumps.

The gases from the material burned on the main grates pass up thru the fresh refuse on the basket grate, then thru a checkered opening in the back of the furnace into a combustion chamber, then thru an air preheater and onto the stack. Forced draft fans supply air to the grates and induced draft fans suck the hot gases thru the ducts and the air preheater.

Part of the steam produced is used to generate electricity to operate the crane, fans and lights, and considerable steam is wasted to the atmosphere.

A light brown smoke was running from the stack. There were no obnoxious odors about the plant.

This incinerator is what is known as the low temperature type.

The chief engineer informed us that the designers guaranteed a maximum temperature in the combustion chamber not to exceed 900° F. but a pyrometer teat showed 1200° F. at times. This was probably due to forcing the plant to a very high rating and it was this action that cracked the stack lining.

The refuse was all delivered in eight hours, whereas the incinerator was operating 24 hours with a force of 90 men, or 30 men per shift.

This particular type of plant must be very uneconomical. There is a large expenditure of money for steam generating equipment and a large part of the steam is wasted to the atmosphere. The maintenance expense is very high on account of trouble experience in the piping outside the furnace. On account of producing high pressure steam the plant must be in charge of a licensed engineer at all times and licensed firemen to the stoking. The work of the fireman is very hard, since cans and other objects stick in the basket grate and they have trouble dislodging them. Considerable unburned material came out of the ashes. Transporting refuse from storage to the charging floor by means of a grab bucket is unsatisfactory, as a great deal of material is dropped on the floor causing an unsanitary condition.

The furnace of this 300-ton plant cost $415,735.00, and now the City of New York is building a new 320-ton Sterling plant at 139th St. The cost of this furnace installation will be $243,000.00. New York is building no more destructors of the DeCarie type.

In our opinion this type of incinerator will soon pass out of competition for the reason that if it is necessary to generate steam, it can be done more economically by installing a standard water tube boiler in such a location that it will be heated by the waste heat from the furnace after complete combustion of the gases has occurred.

NEW YORK - PLANT NO. 2

We visited the plant under construction at 139th Street and the Harlem River.

The concrete framework of the building was erected, but no part of the furnaces was set.

This is to be a four unit incinerator of the Sterling type, with a capacity of 320 tons, and will have two stacks 6'0" at the top and 175 feet high. The incinerator will cost $243,000.00 and the building $436,029.00, making a total of $679,029.00.

Our impression is that this is an excellent layout and provides ample garage storage for equipment besides having the new type mezzanine dumping floor, which provides for dumping on four sides. The ramps are all within the building proper, and the whole presents a very pleasing appearance.

BROOKLYN, N. Y.

The plant is called "The East New York Incinerator" and it is located at Georgia Ave. and Cozine St., Brooklyn. It is of the Sterling design, having two units of three grates each, each unit designed for 50 tons, making the plant capacity 100 tons per day of mixed refuse. There is one stack 6'0" at the top of 175 feet high, lined to the top with fire brick. The incinerator and building cost $200,000.00 and the stack $12,000.00.

This plant is owned and operated by a contractor.

The City contracts each year to deliver the garbage and rubbish from a specified area to the incinerator. The contractor salvages everything of value and burns the remainder. The City pays the contractor a specified amount for each ton of refuse taken and the contractor pays all the operating costs of his plant

The material is delivered in end dump trucks, garbage and rubbish separated. The trucks pass up a ramp into the building to the dumping floor, and from the edge of this floor dump their loads on the charging floor about 8 feet below. The garbage is placed at one end of the charging floor and the rubbish at the other.

On the charging floor 13 pickers sort out and reclaim all cans, paper, rags, metals and bottles. The paper and rags are baled and the metals and cans hauled away and melted into window weights. Metal sells for $6.00 per ton.

Rubbish is in excess of garbage, so that after salvaging the greater part of it there is still enough combustible left to burn the garbage. A small locomotive crane running on a track on the charging floor distributes the refuse to the charging hopper in the proper proportions.

This furnace is of the standard Sterling design similar to the Philadelphia plant. The plant as a whole is being operated economically and satisfactorily. There was very little smoke and no bad odors. The ash conveyor in this plant is operated by compressor air and ashes are blown through a pipe to a cyclone storage bin outside the plant.

BROOKLYN, N.Y.

This plant, located at 8th Street, Brooklyn, is of Heenan & Froude design. The normal rating of this installation is 100 tons, but the contractor claimed he was burning 180 tons of mixed refuse per day.

There were about three times as much rubbish as garbage being received.

The Heenan & Froude furnace is similar to the Sterling, which has been described in detail under the Philadelphia plant. In the Heenan & Froude design the gases are by-passed in such a manner that if it becomes necessary to make repairs to the pre-heater, the gases may be passed directly to the stack and the plant kept in operation. A pyrometer chart showed preheated air temperature of 350° F. and 1700° F. in the combustion chamber. The furnace has a drying ledge 2'0" wide and probably this is the reason for considerable unburned material being seen in the ash. Much of this trouble can be eliminated by proper firing and stoking.

This plant was built and is operated by a contractor. He received from the City 78 cents per yard for garbage and 17 cents per yard for rubbish.

The greater part of the paper, rags and metals is salvaged, but enough combustible is left to burn the garbage.

PATTERSON, N. J.

This is a Heenan & Froude plant built in 1912 by the Power Specialty Company of New York. It has one unit with four grates designed to burn 60 tons of mixed refuse per day. The operating engineer claimed he had burned 168 tons in 19 hours. Forced draft is used, and the unit is served by one stack 150 feet high.

The material is delivered in end dump trucks and deposited in one pile in a pit. From this pit the mixed refuse is picked up by a 1½ yard grab bucket, elevated, and carried to the charging hoppers over the furnace. The charging hoppers hold about 2 yards each. This grab bucket method of handling refuse is very unsatisfactory. Much material is dropped on the top of the furnace, where it becomes heated and gives off obnoxious odors.

Each charging hopper has a sliding door in the bottom, operated by a hydraulic cylinder. Trouble is encountered by leaking cylinders.

In this furnace the gases pass over the grates into a combustion chamber, then through a 150 H.P. Edgemoor water tube boiler supplied with a Foster superheater and then through an air preheater.

The steam generated is partly used to operate a turbo-generator. The electricity developed is used to operate the cranes, light the plant, and to recharge the batteries of a number of electric trucks. A good part of the steam is wasted in an underground cistern.

The ash handling system in use here is the worst we encountered anywhere. The ashes are dropped from the ash pit into a hopper; this hopper is picked up by an electric hoist, then carried along a trolley out into the yard. While held about fifteen feet above the ground the hopper is turned upside down and the ashes dumped to the ground below. The result of this method is that the building and yard are both filled with hot dust whenever ashes are being handled. The operator wore a mask.

Mr. Jenkins, the operating engineer, is in our opinion a very competent man. The plant is obsolete, but the authorities refuse to appropriate the funds necessary to rehabilitate it, or build a new one.

WHITE PLAINS, N.Y.

This is a residential town of about 28,000 people and they spend about $42 000.00 per year on the collection and disposal of refuse. There are no alleys here. Collections are made in the business section each day and in the residential section twice a week.

In 1919 a Nye natural draft incinerator was installed. This plant was unsatisfactory, and is now shut down, but for some reason the City officials erected another Nye furnace similar to the first and of twice the capacity.

The plant now in use was built in 1922, has a designed capacity of 20 tons of mixed refuse, and cost $30,000.00. It is a natural draft plant served by one steel stack 42" in diameter and 50 feet high. This stack is lined with 4-1/2 inches of fire brick.

The material, mostly garbage but with some paper, boxes, etc., is dumped on the charging floor and from here raked through a hole into the furnaces. It drops on a drying space and after drying out by the gases passing over it is raked over the grate where the final burning takes place. The products of combustion pass from the grate over the drying pan down into a flue passing under the drying pan, then into the breeching and on to the stack.

Very poor results were being achieved with this plant. The fire was very weak, the material simply cooking, and unburned garbage and paper were being raked out with the ashes.

Mr. Eugene Halpin, Jr. is Commissioner of Public Works and Mr. A. O. Comstock is the engineer in charge of the incinerator.

TORONTO - WILTON AVE. INCINERATOR:

This plant is of the standard Sterling design and was erected in 1916 by the Canadian Criscom Russell Company at a cost of about $200,000.00. There are five floors, the tipping, the charging, the stoking, the main, and the ash run. The tipping floor is 33 feet above the main or ground floor, and the stoking floor is 7 feet above the same.

There are three units or batteries, each with 4 cells or grates. Each cell has an area of 25 sq. ft. giving each unit an area of 100 sq. ft. and the entire plant a grate area of 300 sq. ft. The furnace was guaranteed to burn 50 pounds of mixed refuse per sq. ft. of grate per hour, making this a 180 ton plant. The plant is served by one stack 175 feet high lined to top with fire brick.

On the official test this plant burned mixed refuse at the rate of 116.5 lbs. per sq. ft. of grate per hour. This is 233 per cent of designed rating. The chimney brickwork is cracked on the outside, both vertical and horizontal cracks being visible. This is probably due to overloading the furnaces.

The material is delivered in end dump wagons, the garbage and rubbish separately. During our visit there were about 50% garbage well wrapped in paper and 50% rubbish consisting of paper, boxes, etc.

The dumping floor extends the full length of the building on one side only, and the refuse is dumped in separate piles on the charging floor below. From these piles it is raked, in the proper proportions into the charging hoppers which hold about 3/4 yard each.

From the charging hopper the mixed refuse is dropped on the drying ledge and after drying out is raked forward on the grate, when the burning is completed.

The ashes are raked from the grates and dropped through a hole in the floor into the ash cars below, then taken to a hoist and carried to an overhead bin, and from there taken away by trucks to a dump. The process of ash removal creates a great deal of dust, and is very unsatisfactory. This could be eliminated by water spray.

From the grates the products of combustion pass into a combustion chamber, through an air preheater and to the stack. A by-pass is provided so that all or part of the gases may be passed directly to the stack.

During our visit all three units were in operation, and the electric pyrometers showed 1400° F. in the combustion chamber of #1, 1800° F. in #2 and 2200° F. in #3. A light gray smoke was issuing from the stack and there were no obnoxious odors.

The operating force consists of a foreman, weigher, one man on dumping floor, three chargers, two stokers, and one ash man to each unit. All material is delivered in 8 hours and the incinerator operates two shifts of 8 hours each.

This plant is very efficiently operated. Mr. John Dyer is the foreman.

TORONTO - WELLINGTON DESTRUCTOR:

This is the second large incinerator built by the City of Toronto. It is a Sterling type with four units and a design capacity of 400 tons of mixed refuse (60% garbage, 40% rubbish) in 24 hours. There are two stacks 90" inside diameter and 175 feet high. Each stack is designed to care for three units.

The dumping floor extends around all four sides of the buildings, and partition walls have been so placed that dust from the front of the furnaces is kept from other parts of the building. Ducts connected to the fans have been placed with openings on the charging floor so that odors from the strewed refuse can be removed.

It was claimed that the fans removed the dust from the ash tunnel, but while we were in this tunnel the dust and gas

ecame so thick that we began to cough and were compelled to eave hurriedly.

Both Toronto plants are well managed. Every effort is ade to secure efficiency, and they are operating satisfactorily.

Mr. F. A. Dallyn, C. E., is Director of Sanitary Engineering, and Mr. J. A. Burnett is Superintendent of Incineration.

ILWAUKEE, WISCONSIN:

This plant of Heenan & Froude design was built in 1910 y the Power Specialty Company of New York. There are four nits, each having six grates. Each unit has a design capacity f 75 tons; therefore, the plant capacity is 300 tons of mixed efuse in 24 hours. During a test in 1919 this plant burned efuse consisting of 57% garbage, 30% ashes, 5% rubbish and 8% anure at a rate of 63 pounds per sq. ft. of grate per hour. his exceeded the guarantee by 10%. The average temperature n the combustion chamber was 1607° F., the minimum 1267° F. nd air supply was 398° F.

The material being delivered during our visit was robably 75% garbage; very little paper or boxes and no cans r bottles. The ashes being delivered came from the gas ompany and looked like coke. The operator informed us that omestic ashes were useless as combustible and that they were ent to the dump.

The garbage is delivered by trains or trailers. These ump into a pit outside the building. From here the material s picked up by a grab bucket and carried to the charging floor. he ashes and rubbish come in at the opposite end of the uilding and are elevated by the crane to the charging floor.

The refuse is mixed on the charging floor in the proper roportions and raked into the charging hopper. From the opper the refuse falls on the drying ledge at the back of he furnace. After drying out it is raked forward on the grate. he ashes are raked from the grate and dropped through a hole n the floor into an ash car below. This car is pushed to the nd of the ash tunnel and the ashes dumped on the floor, then hoveled into a skip hoist and elevated to an overhead bin from hence they are removed by trucks.

The gases pass from the grates into a combustion chamber, hen through an air preheater and an Erie water tube boiler, hen into the stack. There are three boilers giving a total of 00 B.H.P. Steam is generated at about 140# pressure and used o operate turbo-generators, which develop about 600 K. W. ne hundred K. W's are used to operate the plant, and the emaining 500 K. W's are sold to the local power company at /8 cents per K.W.H. It is claimed this means a revenue of bout 33 cents per ton of refuse.

We were informed that they were receiving about 175 tons per day and that all refuse was being delivered between the hours of 4 A. M. and 12 noon, but the incinerator was operating three shifts, 7 A. M. to 3 P. M., 3 P. M. to 11 P. M., and 11 P. M. to 7 A. M.

This plant was handling the worst material we encountered. The fires were rather poor and some unburned material was noticed in the ash.

In common with all plants where the refuse is handled with grab buckets, this plant was very dusty and dirty and obnoxious odors were noticeable.

The operating force consists of 70 men for the three shifts.

Mr. R. E. Stoelling is Commissioner of Public Works; Mr. L. L. Hanafin, Superintendent of Garbage Collection and Disposal, and Mr. A. M. Johnson, General Foreman of the Plant.

EVANSTON, ILL.

This plant built by the Superior Incinerator Company of Dallas, Texas, in 1924 has four twenty ton units making it an 80 ton plant. Each unit has three grates and a drying pan, and is served by a separate chimney; therefore, this plant has four stacks.

The Evanston plant is the first one erected by this Company in the North, and this general design has been evolved from a large number of natural draft units erected in the South. This Company has 23 - 20-ton plants and four 80-ton plants in operation.

The material being received during our visit was very easy to burn. The greater part was paper, boxes and other combustible rubbish and the garbage was all well wrapped in paper.

The refuse is delivered by one ton end dump Ford trucks, and is dumped through a hole in the floor directly into the furnace, If very wet refuse is received, it is dropped on the drying pan and dried out before being raked over upon the grate.

The furnace was working under natural draft, yet a considerable amount of paper, cinders was issuing from the stack.

For a community like Evanston where the refuse is delivered in small amounts, where no storage is required, and it can be dumped directly into the furnace and there is a large percentage of combustible, this type of plant is satisfactory.

OAK PARK, ILL.

This is a natural draft furnace of Lewis & Kitchen design,

built about twenty years ago. It is made up of cast iron plates and lined with fire brick. The refuse simply stews and cooks on the grate. Unburned garbage and paper are raked out with the ashes, and cinders from the stack have caused fires in the vicinity. Boxes and other rubbish are burned on the dump outside the building. Poor design and poor operation make this a very unsatisfactory installation.

CONCLUSIONS

Garbage as received is not a fuel. It contains a large percentage of moisture, and in order to burn, it must be relieved of considerable of this moisture, either by some drying process or by mixing it with some fuel of moderate moisture content which will tend to absorb moisture and reduce the proportions in the whole mass. This fuel must of necessity have good burning quality so that it may effect an evaporation of the moisture when ignition takes place and cause the whole mass to become readily burned.

Rubbish as generally produced in North American municipalities fits this requirement, and the usual amount collected (where rubbish is removed by the municipality) is in quantity just about sufficient to give the proper results with the wettest garbage.

It is highly important that a careful survey be made in order to ascertain whether or not an amount of combustible rubbish sufficient to burn the garbage can be secured. If this rubbish cannot be secured, then some auxiliary fuel must be provided.

After a full knowledge of the material to be burned is secured, the furnace can be designed.

The general layout and design of the building and the system, and amount of storage to be provided will depend upon how, when and in what quantities the refuse is collected. These items are dependent upon local factors; therefore, in the following only the furnace or incinerator proper will be considered.

The basis of design for a successful incinerator is a study of the burning of low grade fuels, especially those which have a high percentage of moisture. Then, too, the absence of voids in the material and the difficulty of so introducing the air to support combustion that it will thoroughly permeate the fuel must be kept in mind.

The fundamental conditions to be studied are:

1. The percentage of moisture present.
2. The percentage of combustible material present.
3. The amount of air necessary to be supplied per unit.

The form of the grate must be adapted to the fuel to secure a proper air supply.

The grate chamber and combustion chamber must be so designed and lined that they will store up heat and by radiation maintain high temperatures.

A proper supply of forced draft air and also a secondary air supply should be provided.

A combustion chamber of such an area, length and shape that the gases will be properly mixed and burned, and that all dust and cinders will be deposited, must be provided.

An air preheater should be provided to preheat both primary forced draft and the secondary air supply.

No cooling elements should be placed in the line of flow of the gases until combustion has been completed.

The stacks should be carefully designed to provide proper draft to overcome friction losses. The lining should be free from the main brickwork and should extend the full height.

The furnace should be so separated from the building that no loads from the latter shall be carried by the furnace structure.

The passage of the material from the tipping floor to the ash car should be by gravity with as little handling as possible. The less mechanical equipment the better.

In an investigation we found three furnaces that met the above requirements for a successful incinerator. They are the Balmer, the Sterling and the Heenan.

The Balmer at Charleston, although not operated as intended by the builders, is giving perfect results. This furnace if designed for Chicago conditions and erected in a building suited to Chicago collection methods, could be depended upon to give results equal to any incinerator now on the market.

The Sterling is a well designed, high-class incinerator. The two plants at Toronto are giving perfectly satisfactory results under the highest class and most efficient operating force that we encountered.

The Heenan furnace is similar to the Sterling. It is well designed and will burn any refuse that can be burned.

Part 2 of this report is a portfolio containing drawings of the incinerators under consideration.

Respectfully submitted,

(signed) Le an D. Gayton

COPY

X-1061
7/25/29

EXHIBIT "E"

August 11, 1928

TO: Mr. E. C. GOODWIN
Examining Engineer.

FROM: J. C. Landon,
Assistant Engineer.

SUBJECT: Goose Island Incinerator, Chicago, Ill.

S I R :

The Following is a general and final report on my observations of the above plant.

Observations were for thirty-six (36) days and covering a period from July 11th to August 11th, inclusive.

PLANT:

Light colored brick building approximately 100' x 175' and built upon a portion of a plot of ground containing 2.23 acres.

Plant is known as the Mutual Assistance type, with the trade name of Superior.

It consists of six 100-ton units with a rated capacity of 600 tons in a 24 hour day.

In general furnaces are constructed like large rectangle brick oven approximately 18' x 28' in size.

They are set in batteries of two and are connected to one combustion chamber with preheater and stack.

Each furnace has eight stoking doors (four on each side) eight shakers, four charging and four air duct controls, the last named being on one side only.

Inside of the furnaces are lined with fire brick, are arched at the top and have staggered baffle walls between stoking doors.

Grates are of the grilled rocker type and have a greater area at the center doors than at the ends. At each stoking door an opening for removal to ash pit of cans, bottles, etc., is provided.

Three (one for each two furnaces) large combustion chambers lined with fire brick are connected to three 140 tube preheaters by a brick grillage, the heaters connecting to three 150' stacks.

EXHIBIT "A"

TO: Mr. E. C. Goodwin

RE: Goose Island Incinerator, Chicago, Ill.

Six 24-inch Sirocco electrically driven fans, taking their air from the stoking floor, and by a system of galvanized iron air ducts forcing the air through the pre-heaters and to the furnace grates for the forced draught.

Approximately 9,000 cu. ft. per minute at a temperature of 300 deg. F. is the action upon each furnace.

On the top of each furnace is a 12" coping to hold materials and four one cu. yd. pipe shaped hopper so placed that they will be in the center of furnace and on a line between stoking doors on each side.

At the bottom of each hopper is a horizontal steel gate operated by air and controlled from one side of furnace.

Ash floor ceilings under furnaces are provided with small oblong hoppers which lead from ash pit under furnace grates.

Hopper buggies are the transporters to chute.

Ash hopper on the outside is of the conveying bottom type and is loaded by a mechanical elevator with a side dumping body which raises from the ash floor. Loading into trucks is by the chute method.

Four electrically operated bridge cranes with one cubic yard clam shell buckets have operating range over dumping pit, and any or all furnace tops.

Dumping pit has a capacity of 1,700 cu. yds., the top of which is at street level and about 6 ft. below top of furnaces, and running for the full length of same.

CRITICISMS:

The plant as a whole is fairly well constructed but some portions show a lack of mechanical design and a knowledge of operating conditions.

The combustion chambers have tuyeres but no mechanical method of taking in auxiliary air which may at times be necessary for proper combustion.

No screens for breaking up particles before they enter stacks.

No provisions for protecting fan and motor from the clouds of dust they are subject to.

Air ducts are galvanized sheet metal and are sleazy and cheaply constructed; this is also true of residue hopper in the yard.

TO: Mr. E. C. Goodwin

RE: Goose Island Incinerator, Chicago, Ill.

Air control should be at each furnace door instead of on one side, this for the safety of the men.

Ash floor designed without any thought of ventilation and as the hot air ducts running to furnaces are not covered, they radiate a heat causing at times a temperature of 130-deg. F. I was in this temperature and know that humans cannot work in it. However, they see their mistake and have now connected up two of the fans and are taking air from this instead of stoking floor, and are covering ducts with asbestos.

The position of the crane cab is such that most of the time bucket is loaded it strikes side of cab and sheet metal has been put on and shown a decided wear.

Layout of dumping floor not good; columns interfere with dumping and no provision made for draining.

Concrete lip to pit is not protected by guards and from trailers striking when dumping, is breaking.

No wheel guards to protect brick work at doors or driveways.

OPERATION:

Refuse is delivered and dumped into storage bin (also coal if being used) and by the buckets of the overhead bridge cranes it is deposited upon top of furnaces.

The man on top of the furnaces, then with a forked hoe, fills the four one yard hoppers.

Assuming fires have been started, the stokers, by means of gate controls, let down into the fire the refuse from the hoppers. After the several loads from each hopper have been let down, four (in each furnace) cone shaped pyramids are formed on the grates between baffle walls and stoking doors.

Practically all the burning is on the surface of the pyramid and the stokers keep pulling this off and agitating the fire by raking and shaking the grates. Charges are let down from the hoppers as fast as the fire, due to burning and stoking, starts to flatten.

When stoking, the draught is shut off under the grate upon which the refuse is being stoked.

Cans, bottles, etc. at times pulled out stoking doors to floor to put in ash pit through small openings provided.

TO: Mr. E. C. Goodwin

RE: Goose Island Incinerator, Chicago, Ill.

THEORY OF BURNING:

The theory of burning in the Mutual Assistance type, such as the Superior, is as follows:

Dropping refuse from the top and upon the grates will form a cone shaped pyramid, and with forced draught burn from the outside.

The agitation by the stoking, the forced preheated draft through the grates, and the increased velocity caused by the staggered baffle plates, will cause a temperature of sufficient degree to burn the refuse and combust the gases and smoke. Specification temperature 1200 deg. F.

OBSERVATIONS:

In actual operation, however, the men seem anxious to keep pushing over and spreading out the piles thereby not allowing to burn sufficiently from the outside, as intended. This causes a large percentage of residue.

An intelligent stoker is a big asset to a plant of this type.

Coal is taken from the bin and usually deposited on stoking floor and shoveled in by the stokers as needed.

At times when a large amount is necessary it is fed through the hoppers at the top.

The men will use coal whenever they can get it, although its use clogs up the grates and makes a hard clinker to get out. In my opinion, too much coal is used.

The operations on ash floor are not good; this is due to arrangement, method and the high temperatures. At times the men cannot work on this floor at all.

REFUSE:

Without separation or the use of receptacles by the householders and the fact that ashes, rubbish, garbage and street sweepings are all collected in the same trailer, an idea of refuse delivered may be had.

During or after a rain it becomes water soaked having been shoveled up on the alleys. I am told refuse which has laid in the alleys from four to six weeks has been brought in, and from what I saw I do not doubt this. To me it is surprising the small amount of wood, such as crates, boxes, and barrels that is delivered.

Most of the garbage is wrapped in newspapers and some of it becomes swill before collected.

Taking it as a whole, I consider it tough material to burn without the use of fuel, but think very little judgment is used in the use of coal.

Specifications call for a moisture of not over 53% and 35% rubbish.

TO: Mr. E. C. Goodwin

RE: Goose Island Incinerator, Chicago, Ill.

Tests made by Chicago Engineers show an average of 62% moisture and 24% rubbish.

RESIDUE: This is high, averaging 15% to 21%.

The engineers tests, using the laboratory ovens, showed 12 to 16% ash and denoting a high percentage of unburnable matter in the refuse.

However, I think the use of too much coal and the hurry up type of stokers are a contributing cause.

SMOKE AND VAPOR:

Entire too much omitted, especially is this true when coal is used. Combustion chamber seems to have very little effect on coal smoke.

The theory of temperatures 1200 deg. F. to 2100 deg. F. is combustion chambers burning all gasses and smoke does not seem to work out in practice, and I believe auxiliary air in the combustion chamber is necessary.

COAL:

For much of the material fuel is necessary for the proper burning, but judgment must be used in its use.

I believe too much coal is being used with the result that at times it is necessary for three men using 3 inch angle iron to break up clinkers.

The type of grate is not suited for the use of so much coal and the burning out of the grates is only a question of a short time.

Unable to get any figures on the amount of coal used, although promised this data by Superintendent of Dumps.

I believe the amount to be at least 5% or 100 lbs. per ton.

Cost of disposition of material is taken for the period of a month- July 11th to August 11, 1928.

Total cost of plant land excepted		$ 822,000.00
Fixed charges		
Cost of building & 3 stacks (estimated)		322,000.00
Cost of equipment		500,000.00
Engineering plans, etc., in above		
Property (estimated no record)		150,000.00
		$ 972,000.00
Depreciation on buildings (40 years)	2-1/2%	8,050.00
Depreciation on equipment (15 years)	6-1/2%	32,500.00
Interest 4-1/2%		43,740.00

TO: Mr. E. C. Goodwin,

RE: Goose Island Incinerator, Chicago, Ill.

Cost of truck and trailers handling residue	
Tractor $ 6,000 - 3 trailers $ 1,000 each . .	$9,000.00
Depreciation (5 years) 20%	1,800.00
Interest 4½%	405.00
Total yearly charges	$ 86,495.00

No taxes considered as Chicago has a fluctuating tax rate which is fixed by Tax Board and I had no means of knowing what this would be.

Salaries and wages from July 11th to August 11th, 1928.

July	11-12-13-14-15	$ 4,018.00	351.33
"	17-18	441.00	50.19
"	19	882.00	100.00
"	20-21	441.00	50.00
"	23	926.00	100.00
"	24-25	463.00	68.16
"	26	926.00	136.32
"	27-28	926.00	136.32
"	30-31	926.00	136.32
Aug.	1-2	1,524.00	222.48
"	3-4-6	2,875.00	570.80
		14,348.00	1,722.87

Total labor cost for 28 days $ 16,070.87

Tons Material Consumed in 28 days - -

Aug.	11	339	July	1	408	Aug. Cont.	
"	12	381	"	2	417	" 21	315
"	13	354	"	3	408	" 23	356
"	14	354	"	4	305	" 24	370
"	16	355	"	6	479	" 25	365
"	17	373	"	7	506	" 26	366
"	18	354	"	8	450	" 27	319
"	19	305	"	9	419	" 28	235
"	20	415	"	10	460	" 30	390
			"	11	230	" 31	355
					4082		6301
							4082
						Total . .	10383

TO: Mr. E. C. Goodwin

RE: Goose Island Incinerator, Chicago, Ill.

COST:

Operating cost per ton -
Total labor cost $16,070.87
Total tons consumed . . . 10,383
16070 + 10383 = $1.55 per ton labor cost

Coal at $4.90 per ton - 100 lbs. per ton material burned = .25 per ton material consumed

Electricity from a bill rendered this average .03 per ton material.
Total operating cost is therefore $1.55 plus .25 plus .03 = $1.83 per ton.

Total cost per ton
Total fixed charges per year of .. $86,495.00
Fixed charges per day $237.00
$ 237.00 per day for 32 days (4 Sundays)
7,584.00
$ 7,584.00 ÷ 10,383 = .73 per ton

Total cost per ton $1.83 plus .73 = $2.56

Actual cost of present operation to City Contractors price per ton $ 2.25 coal .25 City labor .16
Fixed charges .73 = $ 3.39 per ton

Operating cost per ton	$1.83
Total cost per ton	2.56
Total contract operating cost per ton	3.39

CONCLUSIONS

Most of the material delivered is heavy, wet an d without any separation.

Tests made by Chicago Engineers show a percentage of 75% garbage, 24% rubbish, with 62% moisture and 12% ash. These factors are much higher than in the New York material as consumed.

Material delivered has never been equal to the daily rated capacity of plant.

Plant, with the use of coal, can burn the rated tonnage of Chicago material as delivered. However, success of plant to a large extent will depend upon separation.

Plant with the New York separation and the proportions as used, would burn more than the rated capacity.

If rated capacity was consumed, cost per ton would be reduced.

TO: E. C. Goodwin

RE: Goose Island Incinerator, Chicago, Ill.

Operation under contractor is far more economical than can be expected under City operation.

Some of the design of plant and equipment are not in accordance with the best practical methods.

The builders, the Superior Incinerator Company, realizes this and are making the necessary changes.

Plant being new and no one particularly interested in costs, it has been very hard to obtain cost data.

Yours truly,

J. C. L.

Assistant Engineer.

NOTE: - A further investigation in February of 1929 shows cost per ton to be $ 2.[illegible]

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ADDRESS ALL COMMUNICATIONS TO
COMMISSIONER OF STREET CLEANING

EXHIBIT "G"

D. S. C. FORM 222 37 1 30 | 61

137-RCL

CITY OF NEW YORK
DEPARTMENT OF STREET CLEANING
OFFICE OF THE COMMISSIONER
MUNICIPAL BUILDING
NEW YORK CITY

July 26th, 1929.

Mr. M. M. O'Shaughnessy,
City Engineer,
City and County of San Francisco,
California.

My dear Mr. O'Shaughnessy:

At Commissioner Taylor's direction I am enclosing herewith an analysis of the cost of operation for the month of June of the West 30th Street Incinerator (Decarie type) and of the East 73rd Street Incinerator (Sterling type).

There is also enclosed herewith copies of the contracts and specifications for the incinerator constructed in East 73rd Street, New York.

In as much as these copies are the last ones in the file it is requested that you return them as soon as their use is no longer required by you.

With kindest personal regards.

Yours truly,

ELLIS S. GOODELL
Examining Engineer.

- Enclosure -

Exhibit "G"

COST OF OPERATION OF W. 56th ST. INCINERATOR

(Decarie Type)

Fixed Charges:

Cost of Construction of building	$329,631.00	
Installation of equipment	415,735.00	
Engineering (Plans, etc.)	6,028.00	
Property	136,700.00	
Total Cost	$888,094.00	
Depreciation on building (40 yrs.) 2-1/2%		$8,240.00
" " equipment(15 ") 6-1/2%		27,022.00
Interest at 4-1/2%		39,964.00
Cost of truck hauling residue	$4,312.88	
Depreciation (5 yrs) at 20%		862.40
Interest 4-1/2%		194.07
Total yearly charges		$76,282.47
Total charges (one month)		$ 6,356.87

Wages: (Month of June 1928)

Operating Force (Stationary Engineers, Firemen, Oilers, etc.)	20,309.72
Maintenance & Repairs (Mechanics, Electricians, etc.) ..	1,019.25
Supervision: Dump Inspectors and Assistants	1,028.00
Maintenance: Supplies and Materials (estimated)	1,630.00
Total Cost for month June	$30,343.84

Operating Cost - month June--

$30,343.84 less fixed charges 6,356.87 $ 23,986.97

Materials burned June 1929--

Garbage	5,954.42 tons
Rubbish	4,270.00 "
	10,224.42 tons total.

Operating cost per ton- 10,224.42 tons = $23,986.97 = $2.35

Total Cost per ton -- 10,224.42 tons = $30,343.84 = $2.97

Exhibit "G"

COST OF OPERATION OF E. 73rd ST. INCINERATOR

(Sterling Type)

Fixed Charges:

Building	$823,500.
2 Chimneys	29,900.
Furnaces, flues, etc.	227,400.
Plumbing and gas fitting ...	22,142.
Electrical Work	19,083.
Heating and Ventilating	33,510.
Engineering (Estimated) ...	6,500.
Property	100,000.
Total	$ 1,262,035.
Less cost Garage (Estimated)	200,000.
	$ 1,062,035.

Depreciation on building (40 years) 2-1/2%	$13,185.00
" " equipment(15 years) 6-1/2%	14,781.00
Interest @ 4-1/2%	47,791.57
Cost of truck handling residue..... $4,312.88	
Depreciation (5 years) at 20%	862.40
Interest 4-1/2%	194.07
Total yearly charges	$76,814.04
Total charges one month	$ 6,401.17

Operating Charges:

Wages (Month of June 1929)

Operating force (Stationary Engineers, Firemen, Oilers, etc.)	$ 20,662.83
Maintenance & Repairs (Mechanics, Electricians, etc.) ..	48.00
Supervision (Dump Inspectors and Assistants)	648.30
Maintenance (Estimated) Supplies and Materials	100.00
Total Cost for Month of June	$27,859 80

Operating Cost - Month of June

27,859.80 less fixed charges 6,401.17 ..... $21,458.73

Materials burned June 1929--

Garbage	6,422.68 tons
Rubbish	2,674.66 tons
9,097.34 tons total	

Operating cost per ton - 9097.34 tons @ $21,458.73 =	$2.36
Total cost per ton - 9097.34 " " $27,859.80 =	3.06

EXHIBIT "H."

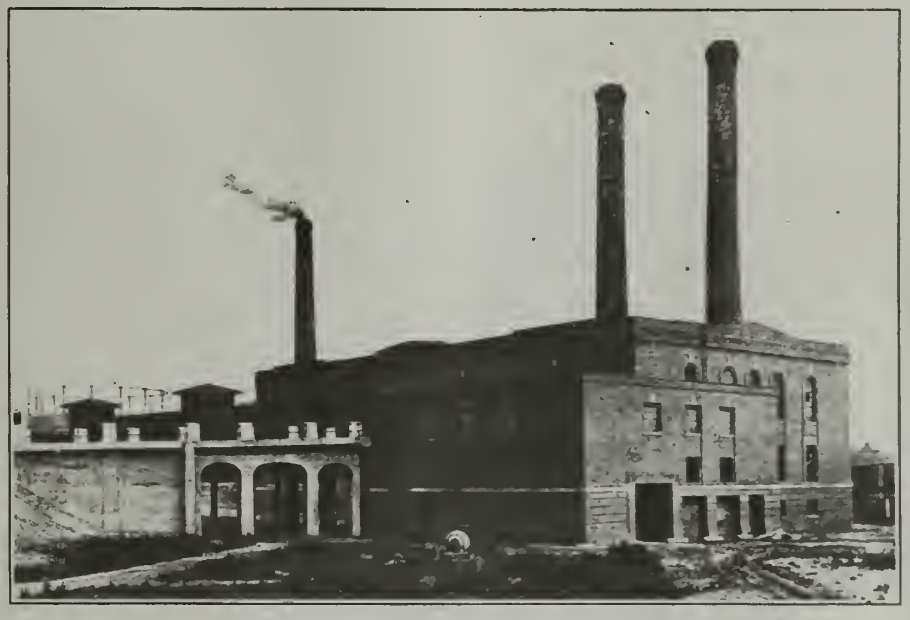
New Refuse Destructor at Toronto, Ont.

New Plant on Wellington Street West, Embodies Latest Improvements in Design — Results Obtained in Official Performance Tests Show Greater Capacity than Guaranteed in Specification—Four Sterling 4-Cell Furnaces

By J. A. BURNETT
Superintendent of Incineration, Department of Street Cleaning, Toronto

ABOUT eleven years ago the Department of Street Cleaning of the city of Toronto conducted an exhaustive survey with respect to its refuse disposal problem. Many large cities in the United States were visited, with a view of adopting the then most modern and effective means of disposal; as a result of that survey the Don destructor plant was projected. During July, 1917, the plant was officially accepted by the city from the contractors, and since that time it has been in continuous operation, with one exception, about 18 months ago, when it became necessary to reline the chimney.

The initial cost of the plant was about $225,000, exclusive of land. The location is ideal, being situated on low-lying ground, with banks on three sides, which permits the material to be delivered to the plant over a level bridge, whilst the vehicles leaving the plant pass over a bridge almost level. There are at least five public institutions in close proximity to the plant, together with the fact that a good class residential district constitutes the neighborhood.



WESTERN ELEVATION OF THE WELLINGTON STREET DESTRUCTOR
The Chimney in the Background from which Smoke is Rising Belongs to the Municipal Abbatoir, Which Ajoins the Destructor Plant

The building portion of the Don destructor is of fireproof construction throughout. The plant consists of three high-temperature 4-cell Sterling furnace units, with combustion chambers, connecting flues, etc., and all appurtenances, including air heaters or regenerators. A Custodis radial brick chimney is built about 25 ft. outside the building, which is equipped with a self-supporting refractory lining, extending from the foundation to the top of the chimney, the inside diameter of which is 90 in. The overall height of the chimney, including octagonal base and radial column, is 175 ft.

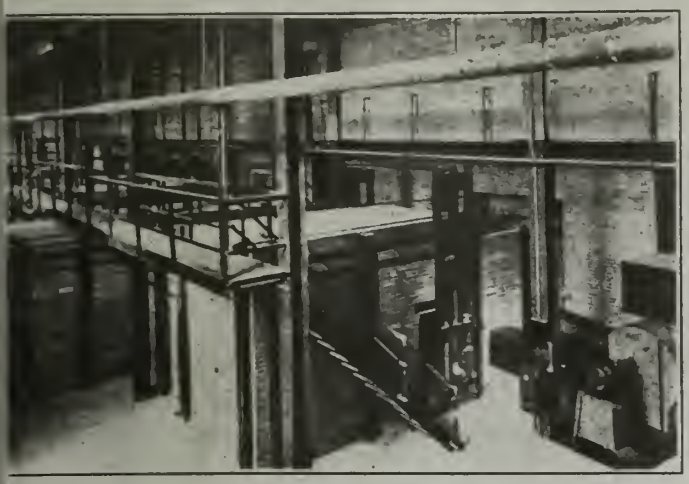
Approximately 50,000 tons of mixed refuse is disposed of at this plant each year, at a cost not exceeding 2½ man hours of labor per ton, which includes labor for operating and repairs, all materials and supplies.

The reduction by weight of the refuse delivered to the plant is about 89%. The material delivered passes over a weigh-scale platform, when the weight is recorded. It is then drawn into the plant on to the tipping floor, where the vehicles are backed, and the contents dumped to the charging floor below. From that point it is charged into the containers of the furnaces by the charging men. The dumping of the containers is controlled from the stoking floor level, compressed air rams being provided for operating the furnace covers, and the container doors. The refuse passing through the opening drops upon a drying hearth inside and at the back of the furnace; it is then drawn over and spread on the grates, where incineration takes place. After the residue has accumulated to such an extent so as not to retard effective burning, large counter-balanced doors at the front of the furnace are raised, and the residue is removed from the grates, dropping by gravity through openings on the stoking floor and is deposited into steel side-dump cars (located in what is known as the ash run) of about 1½ cu. yd. capacity. The trucks are moved over a narrow gauge track and placed bodily upon an electrically operated freight elevator, which raises the residue to the ash bin tipping floor level. On this floor a weigh scale is provided, which records the weight of the residue before dumping it into an elevated ash bin. The removal of the residue is effected by means of adjustable chutes, through which it flows into any desired vehicle, at grade level. It will be noted that the system is gravity throughout, with the one exception, where the residue is raised from the ash run to the bin tipping floor level.

The furnaces are what is known as the continuous grate regenerative type, the cells are divided by low set air-cooled surrounding castings which renders it possible to fire and clean the grates in an individual manner. The gases pass over the cells into the combustion and settling chamber; at the back end of this chamber a firebrick dividing arch is constructed, that splits the gases, a requisite portion of which pass into the air heater or regenerating chamber, the air heater being designed for preheating the forced draught. Any gases not otherwise utilized pass into the bypass flue.

through the connecting flues which are coupled to the main flue, and from thence into the chimney.

Electric motor-driven blowers are furnished for supplying the forced draught. The air which is drawn from the charging floor level, passes from the blower into the air



REAR OF FURNACES WHERE ALL THE AUXILIARIES ARE INSTALLED

Steel Stairways and Overhead Gangways Facilitate Access to all Points

heater, where its temperature is raised from that of the room to about 300° F. The discharge from the regenerator is connected to an air duct at the back of the furnace, which has a discharge outlet into each ash pit. The amount of air is controlled from the furnace front.

The general performance of the Don destructor plant based on eight years of operation, has been very satisfactory. Maintenance costs during that time have been exceptionally low, when consideration is given to the increased rate of burning over guaranteed capacity. Numerous engineering and municipal deputations from all parts of the world have visited the plant from time to time, and as a result it has created, to some extent, an international reputation.

Don Plant Performance Tests

The following statistics were taken from the performance records for the year 1924:

Total loads	47,366
Tonnage	50,995.87 tons
Residue	5,290.21 tons
Reduction by weight	89.6%
Residue by weight	10.4%
Total furnace burning hours	11,200
Total man hours of labor, including foreman, weigh clerk, dumpman, charging men, stokers and ash-run men	70,871
Cost of labor per ton actual burning	1.37 man hours
Total labor cost including actual burning, holidays, sick pay, compensation, and ½ day each week	2 man hours
Total cost per ton, including all labor, materials, supplies, repairs, etc., less carrying charges	2½ man hours
Capacity per furnace hour	4,533 tons
Carcasses destroyed	460 dogs, 290 cats
Foodstuffs destroyed	129,750 lb.

The plant was operated on an average of 5 furnace days per day, 3 during day shifts, and 2 night shifts, each shift of 8 hours duration.

Many years prior to building the Don destructor plant, the Department of Street Cleaning had operated a small low temperature 2-furnace plant of somewhat antique design, which had a capacity of about 80 tons per day of 16 hours. This with the Don plant were handling approximately 50% of the refuse collected, the remainder being dumped. The situation with respect to disposal had become quite grave some three years ago, due to the development of the city, together with the fact that dump facilities were fast becoming remote, also no dependence could be placed on the old crematory to function much longer under forced conditions. As a result of these conditions, the late Geo. B. Wilson, then street commissioner, recommended the building of an additional large capacity destructor plant, which was endorsed by the city council. Specifications were drawn up on a similar system to that of the Don plant, with improvements added that were found to be of benefit in the experience of operating that plant. Just at the time this project was mooted, a certain site was placed on the market which was so admirably located for a plant of this kind, as to represent the hub of a large district from which the major portion of the material could be hauled to the plant by horse-drawn vehicles economically. So with a view of economy in haulage, the street commissioner endeavored to purchase this site, but was unsuccessful in securing authority from the city council, presumably on account of the fact that the city owned a site on which the plant could be constructed, which is situated on the south side of the city, but on the other hand it has become necessary to augment the tractor and trailer service for the collection branch to cope with the requirements, and this condition will continue until such time as another plant is built and operated in the north west section of the city.

The Wellington Street Destructor

The Wellington destructor is located on Wellington Street, West, on the old Cattle Market site, it is connected to Wellington Street by an approach about 250 ft. in length by 24 ft. wide, with about 4% upgrade to the building. The approach is of substantial construction, and designed to carry delivery of material by electric freight car, should conditions warrant same in the future. A large 25-ton weigh scale is located just before entering the building, the platform of

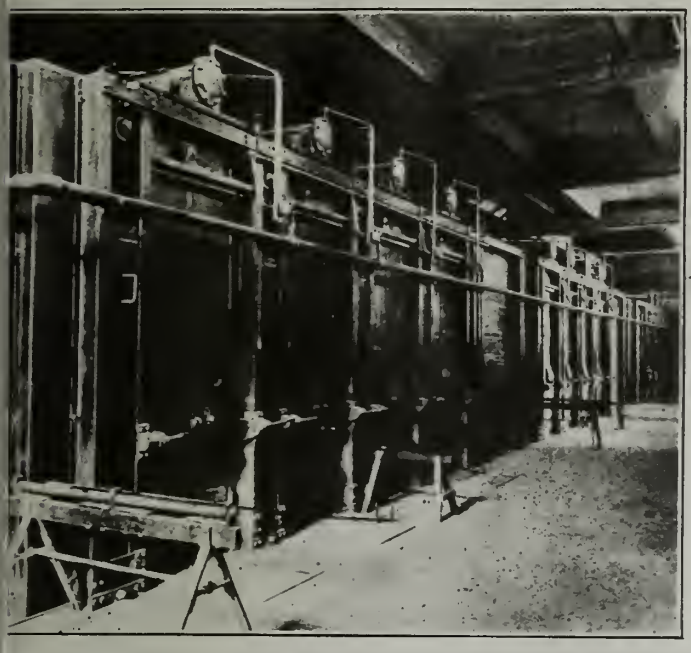
GENERAL VIEW OF CHARGING AND STORAGE FLOOR

The Rectangular Shaped Holes, Seen in the Floor, are the Charging Container Openings. Guard Rails and Chains are Provided for the Safety of the Men

which is 9 ft. wide by 24 ft. in length. The scale and weigh house are integral with the building.

The main building is 180 ft. long, and 100 ft. wide, with roof trusses spanning the entire width, and covered with a reinforced concrete roof upon which felt and gravel roofing is laid. The roof is designed with a monitor extending almost the full length of the building. This monitor is equipped with ventilating louvres. The building throughout is of fireproof construction. It has four floors at different levels. The tipping floor upon which the vehicles travel is located at the same level as the approach. There are tipping floors on each side 35 ft. wide, connected by a bridge across the charging floor 20 ft. wide, so it is possible to dump on each side of

the charging floor which is 10 ft. below the tipping floors. This charging floor extends the full length of the building, and it is 15 ft. wide each side of the charging containers, which are located on the longitudinal centre line of the building. The stoking floor as well as the main floor is 18 ft. below the charging floor level. These floors also represent



GENERAL VIEW OF STOKING FLOOR SHOWING FURNACE FRONTS
Note the Large Guillotine Counterbalanced Doors and Trap Doors on Stoking Floor. Small Doors are used for Stoking the Cells

he low grade level. Another floor known as the ash-run loor is below grade to the extent of about 8 ft.

The capacity of the charging floor is such that it is ossible to store enough material in an eight hour delivery o operate the plant 24 hours. This particular feature is a ecided improvement as compared with the Don plant, which s equipped with one tipping floor only. It is possible to ump 40 rear-dump wagons simultaneously.

The total cost of constructing the plant, including exavations, foundations, building complete with the ramp pproach, furnaces, flues, their appurtenances, chimneys, rading, and engineering, amounted to approximately $550,-00. This cost is slightly less than the initial amount of the)on plant in proportion to the capacity of the two plants. 'he specified capacity was set at 400 tons, with four furnaces 1 a day of 24 hours.

Sterling 4-Cell Furnaces

The equipment of the plant consists of four Sterling 4-cell urnaces complete with combustion chambers, air heaters, onnecting flues, main flues and two radial brick chimneys, nd all appurtenances, including forced draught equipment, ir compressors and temperature recording instruments.

The general arrangements of the flues are such that it is ossible to operate any desired battery of three furnaces toether with any one chimney (each chimney being capable f operating three furnaces in battery), so that at all times ie plant may be operated at not less than 75% capacity.

Dual air compressors are provided so as to be capable f furnishing a constant supply of air for operating the ontainer doors and furnace covers.

Many improvements have been incorporated in the furnce design; the charging hole linings especially have been iodified. This detail in the old type was such that the penings were formed by a series of special shaped large rebrick blocks, which were called on to resist the thrust of ie main roof arch, as well as support the opening. Conderable abrasion to these blocks was the result of friction iused by the passage of the material through the openings, which in a great measure jeopardized the stability of the main roof arch. The new plant is equipped with specially designed air cooled relief beams which support the main roof arch independent of the charging hole openings, and with this method repairs to the openings can be made in an expeditious and economical manner.

The width of the drying hearth has been materially increased, and is such that the whole grate area is effective from a burning standpoint, whereas a certain portion of the grate area in the old type was utilized as a drying hearth.

The continuity of all arches is broken so that repairs can be made when necessary without injury to any contiguous part. Still another advantage has been incorporated in the general layout, in the presence of a brick wall which separates the rear portion of the plant from the furnace room. All the auxiliaries such as blowers, air compressors, motors, etc., are installed in the room apart from the furnaces, which renders it possible to maintain the machine room in a perfectly clean manner free from dust.

The ventilation system is also worthy of mention, the fans being equipped with a dual suction, and can be used as an exhaust fan when cleaning the grates, whereby any smoke is drawn from the ash-run room and passed back into the furnace; also when burning, the air is drawn from the charging floor level, thus removing any odors that may be present there, and creating an inrush of fresh air into the building. Each fan has a capacity under normal conditions equal to 10,000 cu. ft. of air per minute.

Little if any change has been made in the details of the provisions for handling and storing the residue, other than the proportions being greater to meet the increased capacity.

An adequate room designed to garage the motor truck equipment and tractors (used in connection with the plant), is provided, also sanitary dining room, with individual lockers for the men, and a wash room equipped with shower baths, toilets, etc., is added to the sanitary aspects of the plant.

Capacity and Acceptance Tests

The following data are extracts from the departmental engineer's report to the street commissioner on the normal condition, capacity and acceptance tests:

The contract and specifications for the installation of furnaces, flues, chimneys and appurtenances for the refuse incinerating plant at the Western Cattle Market, Wellington Street West, contain stipulations relative to guarantees and

GENERAL ARRANGEMENT OF TIPPING FLOOR
No Obstructions are in Evidence to Prevent Rapid Dumping of Material

tests which have to be complied with by the contractors prior to the acceptance of the plant by the corporation of the city of Toronto, Department of Street Cleaning.

Slow Burning Fires

The construction portion of the contract was completed late in December, 1924, when the contractors started slow burning fires in the furnaces, and maintained same for the purpose of thoroughly drying the brickwork of the plant, which was continued until Monday, January 12, 1925, when

in accordance with Section 104 of the specifications, the normal operation test of 30 days duration was commenced.

Normal Operation Test

The plant was operated during this test, under the supervision of the contractor's engineer; all labor and materials being furnished by the Department of Street Cleaning.

At this season of the year, the average nature of the material delivered to the plant is somewhat extreme, inasmuch as any moisture-bearing material is frozen, and also no small amount of snow and ice is to be found among the refuse, which materially militates against rapid burning, together with the fact that considerable additional heat is required to thaw the material before the normal process of incineration is possible.

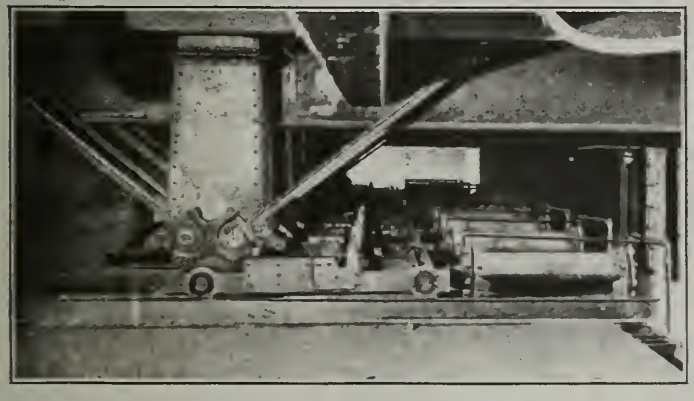
The plant was operated from all angles during the 30-day period, by selecting different furnaces operating with each chimney, and separately.

Observations were made continuously during the normal operation test period, and the performance of the plant as a whole demonstrated its capability to perform, or do that which the specifications required of it, to the satisfaction of the department's engineer.

The above mentioned test was completed on Saturday, February 14, 1925, when the plant was operated under the supervision of the department.

Capacity and Acceptance Test

The contractors advised that it was their intention, if convenient to the department to conduct the prescribed test for the guarantee of operation, fulfillment of guarantee, tonnage, in accordance with Sections 93, 97 and 100, not later than April 30th, with the result that arrangements were made to comply therewith. On the Wednesday night, prior to the commencement of the test, the south charging floor was left with no refuse thereon, and sufficient stored on the north floor to start up the furnaces, and bring them up to temperature, prior to starting the test. All refuse delivered on Thursday was dumped onto the south charging floor opposite Nos. 2, 3 and 4 furnaces. Accurate records of the total weight delivered, together with the



View of Top of Furnaces Showing Containers and Charging Mechanism

amount for each furnace were kept, and no material was charged into any furnace, from the piles until the start of test.

Description of Refuse

The refuse delivered for the test was the result of normal departmental collections, consisting of a mixture of rubbish and garbage, wrapped domestic refuse, store, market, and warehouse waste; the proportion of which was, as near as could be ascertained by observation, 60% garbage and 40% rubbish by weight. No ashes or incombustible material other than small cans, bottles, etc., normally collected, were delivered to the plant.

Furnaces Employed in Test

Furnaces Nos. 2, 3 and 4 were the units selected for the test, with No. 2 chimney operating in conjunction with units 3 and 4, and No. 2 furnace operating with No. 1 chimney, with partially closed chimney damper to balance. It may here be pointed out that during the normal operation test it was found possible to operate any desired battery of 3 units, together with either stack individually; but it was deemed inadvisable to force a separate chimney on a maximum capacity test.

Method of Conducting Test

Thursday, April 30th, fires were started at 9.35 a.m. (all grates and ashpits being previously cleaned) with material

Interoir View of the Ash-Run Floor Under the Furnaces

The Residue from the Furnaces Passes Through the Chutes into the Side Dump Steel Cars Shown on the Narrow-Gauge Track

from the pile delivered on Wednesday afternoon; the fires were built up under natural draught until 9.55 a.m., when the fans for supplying forced draught were started, and 5 minutes later, or at 10 o'clock, the test commenced. Observations were taken as to the condition of the charging containers and grates, together with readings of electric power meter, temperatures, air pressures, draught, etc., at the start and at 30 minute intervals throughout the test. Sample of refuse for analysis was drawn during the test.

Observations were made at frequent intervals with respect to the functioning of the plant as a whole, particular attention being given to the condition of residue when grates were being cleaned; the grates were cleaned three times during the test, the first draw was made about 11.30 a.m., the corresponding cell in each unit being cleaned almost simultaneously with an interval of about 12 minutes between the clinkering of the different cells of each unit. An accurate record was kept of the weight of residue from the grates and ashpits, due allowance being made at the end of the test for the amount of residue from the material used in bringing the furnaces up to temperature.

Result or Data or Test

Date, Thursday, April 30, 1925.

Weather—Cloudy (recorded by Observatory).

Temperature noon 48°; barometer, 29.38 noon.

Humidity noon 62; wind east, 11 miles.

Start of test	10.00 a.m.
Finish of test	6.15 p.m.
Duration of test	8 hr., 15 min
Weight consumed, No. 2 furnace	86.15 tons
Weight consumed, No. 3 furnace	78.14 tons
Weight consumed, No. 4 furnace	82.89 tons
Total consumed, all furnaces	247.18 tons
Number charges, No. 2 furnace	518
Number charges, No. 3 furnace	495
Number charges, No. 4 furnace	492
Total charges, all furnaces	1,505
Average weight of charge, No. 2 furnace	332.64 lb.
Average weight of charge, No. 3 furnace	315.71 lb.
Average weight of charge, No. 4 furnace	337.00 lb.
Average weight of charge, all furnaces	328.48 lb.
Weight of residue	27.83 tons
Percentage reduction by weight	88.74%
Percentage residue by weight	11.26%

Analysis of Sample

Percentage of moisture	51.59%
Pounds moisture per ton	1,031.8 lb.
Percentage of combustible	37.46%
Pounds combustible per ton	749.2 lb.
Percentage of residue	10.95%
Area of grate surface per unit	100 sq. ft.
Area of grate surface, 3 furnaces 3 by 100 ft.	300 sq ft.
Actual rate of burning sq. ft. grate per hr. obtained	199.75 lb.
Required rate of burning sq. ft. grate per hr. Section 22	83.33 lb.
Guaranteed rate of burning sq. ft. grate per hr. by contractor	100.00 lb.
Actual tons per furnace hour	9.98 tons
Required tons per furnace hour	4.16 tons
Guaranteed tons per furnace hour	5 tons
Actual increase percentage over specified	139.71%
Actual increase percentage over guaranteed	99.75%

Furnace No. 2

Maximum temperature combustion chamber	2,100° F.
Minimum temperature combustion chamber	1,400° F.
Average temperature combustion chamber	1,997° F.
Maximum temperature air regenerator	380° F.
Minimum temperature air regenerator	260° F.
Average temperature air regenerator	330.3° F.
Average air pressure at fan discharge	3.46 in.
Average air pressure at ashpits	0.7 in.

Furnace No. 3

Maximum temperature combustion chamber	2,400° F.
Minimum temperature combustion chamber	1,650° F.
Average temperature combustion chamber	2,094° F.
Maximum temperature air regenerator	425° F.
Minimum temperature air regenerator	290° F.
Average temperature air regenerator	352.5° F.
Average air pressure at fan discharge	3.13 in.
Average air pressure at ashpits	0.6 in.

Furnace No. 4

Maximum temperature combustion chamber	2,275° F.
Minimum temperature combustion chamber	1,400° F.
Average temperature combustion chamber	2,034° F.
Maximum temperature air regenerator	400° F.
Minimum temperature air regenerator	300° F.
Average temperature air regenerator	342° F.
Average air pressure at fan discharge	3.2 in.
Average air pressure at ashpits	0.9 in.

No. 2 Chimney

Maximum temperature at base	1,570° F.
Minimum temperature at base	1,040° F.
Average temperature at base	1,282° F.
Maximum chimney draught	1.5 in.
Minimum chimney draught	1.3 in.
Average chimney draught	1.4 in.

No. 1 Chimney

No temperature recorded.	
Maximum chimney draught	1.4 in.
Minimum chimney draught	1.2 in.
Average chimney draught	1.4 in.
Average time between clinkering	2 hr., 35 min.
Average time taken for clinkering	2.8 min.
Condition of residue	Very good
Total man hours of labor, actual burning, including leading stoker, stokers and ash-run men	74½ hr.
Man hours of labor per ton, as above	0.3 hr.
Guaranteed man hours of labor per ton, as above	0.5 hr.
Total man hours of labor employed on test, including foreman, weigh clerk, dumpman, charging men, leading stokers, stokers and ash-run men	194½ hr.
Man hours of labor per ton, including men as above enumerated	0.79 hr.
Electric power consumed during test for operating forced draught equipment, air compressor, and elevator	390 k.w.h.
K.W.H. per ton of refuse	1.21 k.w.h.

The above data covers in a complete manner the results attained during the test.

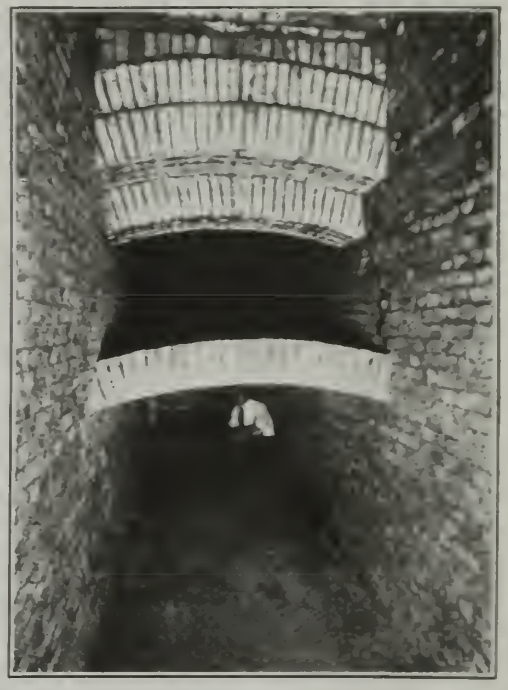
Guarantee for Condition of Operation

Section 93 of the specifications reads as follows:

The contractor hereby guarantees that the following conditions will be fulfilled, subject to the judgment of the engineer, when the furnaces are incinerating refuse, without additional fuel, at or about their rated capacities, refuse containing not more than 940 lb. of water per ton, determined by evaporation tests, and not less than 460 lb. of combustible per ton determined by combustion tests.

(a) That at no time during the normal operation of the furnaces will the temperature in the combustion chambers, and as ascertained from a continuous record, during the time of testing, fall below 1,250 degrees Fah. for more than three minutes in any one hour, and that an average temperature therein of at least 1,400 degrees Fah. will be maintained.

(b) That the residue from the furnaces will be thoroughly burned, and shall not contain more than one per cent. of organic matter, exclusive of carbon.



INTERIOR VIEW LOOKING INTO COMBUSTION CHAMBER
Shows Dividing Arch and Admission Openings into Regenerator and By-Pass Flue

(c) That the number of pounds of refuse per hour which will be incinerated per cell or grate upon which combustion takes place, will not be less than that stated in the tender.

(d) That there will be no smoke at any time escape from the chimney of a degree of darkness or density greater than that determined by Chart No. 1 of Ringleman's smoke scale, as supplied by the United States Geological Survey.

(e) That there will be no dust emitted from the top of the chimney.

(f) That the man hours of labor per ton of refuse incinerated, computed according to Sec. 109, will not be greater than stated in the tender.

(g) That the flues, dust collectors, furnaces and combustion chambers will be so arranged that it shall not be necessary to shut down any one unit for more than twenty-four hours in any one week, in order to thoroughly remove the dust and ashes.

Observations, in addition to the statistics herein shown, were made with respect to the fulfillment of the required guarantees, the result of which are as follows:

The moisture content of the refuse as ascertained from the sample was 1,031.8 lb., which amount is 91.8 lb. per ton greater than that specified; on the other hand, the amount of combustible was found to be 289.2 lb. per ton in excess of the specification, which rendered the class of material slightly

ter than the prescribed proportions. The rate of burning, wever, was so much greater than either the specified or aranteed amount, that it offset any slight advantage in e nature of the material.

With respect to paragraph "A" of Section 93, the com-stion chamber temperature of any furnace was never less n 1,400 deg. F.; also the loss of temperature during clink-ng periods never exceeded 250 deg. F. The minimum tem-rature of 1,400 deg. F. of Nos. 2 and 4 combustion ambers, was recorded between 1.00 and 3.00 p.m., during ich time there was a dearth of material opposite those rticular furnaces.

Observations of the residue from the furnaces, referred in paragraph "b," revealed the fact that the refuse was

VIEW OF FURNACE GRATES UNDER CONSTRUCTION
Shows Surrounding Castings of Cells and General Interior Detai s

duced to greatest extent, also a considerable amount of nocuous clinker was removed from the grates every draw; one time only a slight trace of vegetable matter was ticed, when a grate was being cleaned, which amount was finitesimal. With this one exception the material was well rned, and the amount of organic matter was considerably low the allowable limit of 1%.

The rate of burning per cell or grate, obtained was 199.75 lb. per sq. ft. of grate area per hour. The guaranteed rate was 100 lb. The results attained were 99.75% in excess of the guaranteed, which fully complies with paragraph "c."

At frequent intervals during the test, observations were made of the chimney discharge. During the major portion of the test, a transparent heat wave only was apparent, whilst the color of the discharge for the remaining time was a very light grey. At the same time these observations were made, no emission of dust from the chimneys was in evidence.

The guaranteed man hours of labor per ton of refuse incinerated was 0.5; the results of the test reduced that figure to 0.3, thus more than complying with paragraph "f."

The arrangement of flues, dust collectors, furnaces, and combustion chambers, is such that it is possible to properly or thoroughly remove the dust accumulated in the different parts after a normal run of a week's duration, in about 2½ hours. This work is usually done before starting the plant on Monday of each week.

The plant as a whole, either from a construction or operation viewpoint, has been respectively built, and operated so that it fully complies with the requirements of the specifications and general conditions of the contract; as a matter of fact, judging its performance, from start to date, it has been apparent that the rate of the satisfactory disposal of refuse (even during the winter season), under normal conditions, has exceeded all expectations.

It is but fair at this juncture to refer to the manner in which the men worked, especially during the acceptance and capacity test, and to say the least, their action is to be commended, as the almost unbelievable results attained at that time were greatly attributive to their efforts.

In conclusion, also in view of the foregoing, it is respectfully recommended that the plant, consisting of the furnaces, flues, chimneys and appurtenances, be accepted from the contractors.

The preparation of specifications and all engineering in connection with the Wellington plant was undertaken by the engineering branch of the Department of Street Cleaning. The construction and operation of all plants comes under the jurisdiction of Geo. W. Dies, Street Commissioner. All plans and specifications for the building portion of the plant were prepared by the City Architect's Department, of which J. J. Woolnough is head. This particular branch was under the jurisdiction of K. S. Gillies. The construction of the building was executed under a series of contracts by local contractors.

Messrs. Francis Hankin and Co. Ltd., of Montreal and Toronto, were the contractors for all furnaces, flues, chimneys and their appurtenances. This company is the Canadian representative of the C. O. Bartlett and Snow Co. of Cleveland, Ohio, who represent the Sterling interest in the United States.

The writer, J. A. Burnett, who is the superintendent of incineration of the Department of Street Cleaning, and supervising engineer of the Wellington plant, is directly responsible to the Street Commissioner for the operation of the refuse destructors in the city of Toronto.

Printed in Canada

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Olmsted

71

JOHN C. SHAW
CITY ENGINEER
RALPH W. STEWART
CHIEF DEPUTY

BOARD OF PUBLIC WORKS

CITY OF LOS ANGELES

ENGINEERING DEPARTMENT

WHEN ANSWERING
REFER TO FILE NUMBER

POLITAN 5200

DATE August 1,1929.
FILE No. 34
SUBJECT Garbage - Rubbish
Methods and cost of handling

Mr.M.M.O'Shaughnessy
City Engineer
San Francisco,California

Dear Sir:

We appreciate your letter of July 27th advising the method used by you of eliminating the sewage odor in a small sewage plant.

Answering your question regarding our garbage, enclosed is reprint of magazine article setting forth in detail our methods and costs of handling garbage. The classification and disposal of other wastes are also briefly covered , also the source of the funds for handling each kind of waste material.

The summary of this year's garbage collection work taken from the annual report we have just compiled,is as follows:-

Total tonnage collected (domestic garbage only except as noted) -
By City forces in central district (Scale weights), 158,801 Tons
Contract collection in suburbs (estimated), 23,379 " *
182,180

Cost of collection by City forces in central district, $588,295.00
Cost of contract collection in suburbs(domestic rubbish included), $ 94,243.00**
$682,538

Revenue actually received from sale of garbage after collection, $ 95,507.00
(The garbage from central district is sold for 60¢ per ton F.O.B. cars Los Angeles). $587,031

yearly bill for collection

I am advised that the minimum charge for garbage collection service in San Francisco is 45¢ per month, and that the average cost is 75¢ per month. In Los Angeles where garbage is collected by City forces the average cost per pickup counting large hotels and restaurants, as single pickups, is about 37¢ per month.

This is evidently because in San Francisco the charges include disposal cost instead of sale revenue, and collectors in San Francisco enter the premises,whereas in Los Angeles property owners set their garbage out for collection. Also the quality of garbage in Los Angeles is protected by ordinance as set forth in enclosed re-print.

Got letter $3.22

68 10M-7-28

JOHN C. SHAW
CITY ENGINEER
RALPH W. STEWART
CHIEF DEPUTY

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BOARD OF PUBLIC WORKS

CITY OF LOS ANGELES

ENGINEERING DEPARTMENT

POLITAN 5200

WHEN ANSWERING
REFER TO FILE NUMBER

DATE
FILE NO.
SUBJECT

Yours truly,

JOHN C. SHAW, City Engineer.

By _____
(R.W.Stewart)
Chief Deputy.

* Weight is garbage only

** This contract price includes cost of collecting domestic rubbish as well as garbage.

RWS:KVR

DEPARTMENT OF PUBLIC WORKS OF

THE CITY OF SEATTLE

OFFICE OF CITY ENGINEER.

W. D. BARKHUFF, C. E. CITY ENGINEER

IN RE:

July 31 1929

Mr. M. M. O'Shaughnessy,
City Engineer,
San Francisco, California.

Dear Sir:

Replying to your favor of the 26th, requesting information relative to the collection of garbage and ashes, please be advised that the collection of "garbage" includes the collection of all waste materials and refuse, tied in bundles or placed in cans, from all residences, apartment houses, hotels and business properties, and is paid for from funds collected in the general tax levy. The work is under the direction of the Department of Health and Sanitation, with an M.D. at the head of the department.

The garbage division operates under a superintendent; the equipment for collection is owned by private individuals who are paid a stipulated amount per hour, this compensation being regulated by the City Council. The laborers used in connection with the collecting of the garbage are paid by the three companies supplying trucks, they being reimbursed by the City for this expenditure.

Swills are collected by a company operating a hog farm, no compensation going to the producer of the swill, the company making the collections having a contract with the City which is authorized by the City Council. No charge is made against the City for this service.

The personnel of the garbage division is:

1 Superintendent of garbage disposal -	$3240.
6 Foreman, garbage	11520.
1 Salvager	2280.
1 Utility laborer	1700.
Laborers	42882.
Shops and fills, sundry expenses	2000.
Collection, truck and team hire	638000.
	$701622

Weekly collections are made, except in the business districts, where nightly collections are made.

All refuse is delivered at dumps where "sanitary fills" are being made. These fills are low-lying areas. The tops of the dumps are kept covered with earth. Trucks without trailers are used exclusively in this service.

In this connection, you might be interested in knowing that the total appropriation for the Department of Health and Sanitation , for the year 1929, was $1,410,077.

Trusting that I have supplied you all the information you desire, I remain,

Very truly yours,

W. D. BARKHUFF
City Engineer

WDB:C

I N D E X

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